REPORT DOCUMENTATION PAGE

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searchi ... wing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggesti ... ation Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwo

AFRL-SR-BL-TR-00-

0725

1. AGENCY USE ONLY *(Leave blank)*	2. REPORT DATE	3. REPORT
	December, 1995	

4. TITLE AND SUBTITLE
1995 Summer Research Program (SRP), Program Management Report, Vol. 1

5. FUNDING NUMBERS
F49620-93-C-0063

6. AUTHOR(S)
Gary Moore

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
Research & Development Laboratories (RDL)
5800 Uplander Way
Culver City, CA 90230-6608

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
Air Force Office of Scientific Research (AFOSR)
801 N. Randolph St.
Arlington, VA 22203-1977

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION AVAILABILITY STATEMENT
Approved for Public Release

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*
The United States Air Force Summer Research Program (USAF-SRP) is designed to introduce university, college, and technical institute faculty members, graduate students, and high school students to Air Force research. This is accomplished by the faculty members, graduate students, and high school students being selected on a nationally advertised competitive basis during the summer intersession period to perform research at Air Force Research Laboratory (AFRL) Technical Directorates and Air Force Air Logistics Centers (ALC). The management volume consists of a program overview, program management statistics, a listing of the participants, and an abstract for each participants summer research.

14. SUBJECT TERMS
Air Force Research, Air Force, Engineering, Laboratories, Reports, Summer, Universities, Faculty, Graduate Student, High School Student

15. NUMBER OF PAGES

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
Unclassified	Unclassified	Unclassified	UL

GENERAL INSTRUCTIONS FOR COMPLETING SF 298

The Report Documentation Page (RDP) is used in announcing and cataloging reports. It is important that this information be consistent with the rest of the report, particularly the cover and title page. Instructions for filling in each block of the form follow. It is important to ***stay within the lines*** to meet ***optical scanning requirements.***

Block 1. Agency Use Only *(Leave blank)*.

Block 2. Report Date. Full publication date including day, month, and year, if available (e.g. 1 Jan 88). Must cite at least the year.

Block 3. Type of Report and Dates Covered. State whether report is interim, final, etc. If applicable, enter inclusive report dates (e.g. 10 Jun 87 - 30 Jun 88).

Block 4. Title and Subtitle. A title is taken from the part of the report that provides the most meaningful and complete information. When a report is prepared in more than one volume, repeat the primary title, add volume number, and include subtitle for the specific volume. On classified documents enter the title classification in parentheses.

Block 5. Funding Numbers. To include contract and grant numbers; may include program element number(s), project number(s), task number(s), and work unit number(s). Use the following labels:

C - Contract	**PR** - Project
G - Grant	**TA** - Task
PE - Program Element	**WU** - Work Unit Accession No.

Block 6. Author(s). Name(s) of person(s) responsible for writing the report, performing the research, or credited with the content of the report. If editor or compiler, this should follow the name(s).

Block 7. Performing Organization Name(s) and Address(es). Self-explanatory.

Block 8. Performing Organization Report Number. Enter the unique alphanumeric report number(s) assigned by the organization performing the report.

Block 9. Sponsoring/Monitoring Agency Name(s) and Address(es). Self-explanatory.

Block 10. Sponsoring/Monitoring Agency Report Number. *(If known)*

Block 11. Supplementary Notes. Enter information not included elsewhere such as: Prepared in cooperation with....; Trans. of....; To be published in.... When a report is revised, include a statement whether the new report supersedes or supplements the older report.

Block 12a. Distribution/Availability Statement. Denotes public availability or limitations. Cite any availability to the public. Enter additional limitations or special markings in all capitals (e.g. NOFORN, REL, ITAR).

DOD - See DoDD 5230.24, "Distribution Statements on Technical Documents."
DOE - See authorities.
NASA - See Handbook NHB 2200.2.
NTIS - Leave blank.

Block 12b. Distribution Code.

DOD - Leave blank.
DOE - Enter DOE distribution categories from the Standard Distribution for Unclassified Scientific and Technical Reports.
Leave blank.
NASA - Leave blank.
NTIS -

Block 13. Abstract. Include a brief *(Maximum 200 words)* factual summary of the most significant information contained in the report.

Block 14. Subject Terms. Keywords or phrases identifying major subjects in the report.

Block 15. Number of Pages. Enter the total number of pages.

Block 16. Price Code. Enter appropriate price code *(NTIS only)*.

Blocks 17. - 19. Security Classifications. Self- explanatory. Enter U.S. Security Classification in accordance with U.S. Security Regulations (i.e., UNCLASSIFIED). If form contains classified information, stamp classification on the top and bottom of the page.

Block 20. Limitation of Abstract. This block must be completed to assign a limitation to the abstract. Enter either UL (unlimited) or SAR (same as report). An entry in this block is necessary if the abstract is to be limited. If blank, the abstract is assumed to be unlimited.

UNITED STATES AIR FORCE

SUMMER RESEARCH PROGRAM -- 1995

SUMMER RESEARCH PROGRAM FINAL REPORTS

VOLUME 1

RESEARCH & DEVELOPMENT LABORATORIES

5800 Uplander Way

Culver City, CA 90230-6608

Program Director, RDL
Gary Moore

Program Manager, AFOSR
Major David Hart

Program Manager, RDL
Scott Licoscos

Program Administrator, RDL
Gwendolyn Smith

Program Administrator, RDL
Johnetta Thompson

Submitted to:

AIR FORCE OFFICE OF SCIENTIFIC RESEARCH

Bolling Air Force Base

Washington, D.C.

December 1995

PREFACE

Reports in this volume are numbered consecutively beginning with number 1. Each report is paginated with the report number followed by consecutive page numbers, e.g., 1-1, 1-2, 1-3; 2-1, 2-2, 2-3.

This document is one of a set of 16 volumes describing the 1995 AFOSR Summer Research Program. The following volumes comprise the set:

VOLUME	TITLE
1	Program Management Report
	Summer Faculty Research Program (SFRP) Reports
2A & 2B	Armstrong Laboratory
3A & 3B	Phillips Laboratory
4	Rome Laboratory
5A, 5B, & 5C	Wright Laboratory
6A & 6B	Arnold Engineering Development Center, Wilford Hall Medical Center and Air Logistics Centers
	Graduate Student Research Program (GSRP) Reports
7A & 7B	Armstrong Laboratory
8	Phillips Laboratory
9	Rome Laboratory
10A & 10B	Wright Laboratory
11	Arnold Engineering Development Center, Wilford Hall Medical Center and Air Logistics Centers
	High School Apprenticeship Program (HSAP) Reports
12A & 12B	Armstrong Laboratory
13	Phillips Laboratory
14	Rome Laboratory
15A&15B	Wright Laboratory
16	Arnold Engineering Development Center

TABLE OF CONTENTS

INTRODUCTION

The Summer Research Program (SRP), sponsored by the Air Force Office of Scientific Research (AFOSR), offers paid opportunities for university faculty, graduate students, and high school students to conduct research in U.S. Air Force research laboratories nationwide during the summer.

Introduced by AFOSR in 1978, this innovative program is based on the concept of teaming academic researchers with Air Force scientists in the same disciplines using laboratory facilities and equipment not often available at associates' institutions.

The Summer Faculty Research Program (SFRP) is open annually to approximately 150 faculty members with at least two years of teaching and/or research experience in accredited U.S. colleges, universities, or technical institutions. SFRP associates must be either U.S. citizens or permanent residents.

The Graduate Student Research Program (GSRP) is open annually to approximately 100 graduate students holding a bachelor's or a master's degree; GSRP associates must be U.S. citizens enrolled full time at an accredited institution.

The High School Apprentice Program (HSAP) annually selects about 125 high school students located within a twenty mile commuting distance of participating Air Force laboratories.

AFOSR also offers its research associates an opportunity, under the Summer Research Extension Program (SREP), to continue their AFOSR-sponsored research at their home institutions through the award of research grants. In 1994 the maximum amount of each grant was increased from $20,000 to $25,000, and the number of AFOSR-sponsored grants decreased from 75 to 60. A separate annual report is compiled on the SREP.

The numbers of projected summer research participants in each of the three categories and SREP "grants" are usually increased through direct sponsorship by participating laboratories.

AFOSR's SRP has well served its objectives of building critical links between Air Force research laboratories and the academic community, opening avenues of communications and forging new research relationships between Air Force and academic technical experts in areas of national interest, and strengthening the nation's efforts to sustain careers in science and engineering. The success of the SRP can be gauged from its growth from inception (see Table 1) and from the favorable responses the 1995 participants expressed in end-of-tour SRP evaluations (Appendix B).

AFOSR contracts for administration of the SRP by civilian contractors. The contract was first awarded to Research & Development Laboratories (RDL) in September 1990. After

completion of the 1990 contract, RDL (in 1993) won the recompetition for the basic year and four 1-year options.

2. PARTICIPATION IN THE SUMMER RESEARCH PROGRAM

The SRP began with faculty associates in 1979; graduate students were added in 1982 and high school students in 1986. The following table shows the number of associates in the program each year.

Table 1: SRP Participation, by Year

YEAR	Number of Participants			TOTAL
	SFRP	GSRP	HSAP	
1979	70			70
1980	87			87
1981	87			87
1982	91	17		108
1983	101	53		154
1984	152	84		236
1985	154	92		246
1986	158	100	42	300
1987	159	101	73	333
1988	153	107	101	361
1989	168	102	103	373
1990	165	121	132	418
1991	170	142	132	444
1992	185	121	159	464
1993	187	117	136	440
1994	192	117	133	442
1995	190	115	137	442

Beginning in 1993, due to budget cuts, some of the laboratories weren't able to afford to fund as many associates as in previous years. Since then, the number of funded positions has remained fairly constant at a slightly lower level.

3. RECRUITING AND SELECTION

The SRP is conducted on a nationally advertised and competitive-selection basis. The advertising for faculty and graduate students consisted primarily of the mailing of 8,000 52-page SRP brochures to chairpersons of departments relevant to AFOSR research and to administrators of grants in accredited universities, colleges, and technical institutions. Historically Black Colleges and Universities (HBCUs) and Minority Institutions (MIs) were included. Brochures also went to all participating USAF laboratories, the previous year's participants, and numerous individual requesters (over 1000 annually).

RDL placed advertisements in the following publications: *Black Issues in Higher Education, Winds of Change,* and *IEEE Spectrum.* Because no participants list either *Physics Today* or *Chemical & Engineering News* as being their source of learning about the program for the past several years, advertisements in these magazines were dropped, and the funds were used to cover increases in brochure printing costs.

High school applicants can participate only in laboratories located no more than 20 miles from their residence. Tailored brochures on the HSAP were sent to the head counselors of 180 high schools in the vicinity of participating laboratories, with instructions for publicizing the program in their schools. High school students selected to serve at Wright Laboratory's Armament Directorate (Eglin Air Force Base, Florida) serve eleven weeks as opposed to the eight weeks normally worked by high school students at all other participating laboratories.

Each SFRP or GSRP applicant is given a first, second, and third choice of laboratory. High school students who have more than one laboratory or directorate near their homes are also given first, second, and third choices.

Laboratories make their selections and prioritize their nominees. AFOSR then determines the number to be funded at each laboratory and approves laboratories' selections.

Subsequently, laboratories use their own funds to sponsor additional candidates. Some selectees do not accept the appointment, so alternate candidates are chosen. This multi-step selection procedure results in some candidates being notified of their acceptance after scheduled deadlines. The total applicants and participants for 1995 are shown in this table.

Table 2: 1995 Applicants and participants

PARTICIPANT CATEGORY	TOTAL APPLICANTS	SELECTEES	DECLINING SELECTEES
SFRP	572	188	39
(HBCU/MI)	(119)	(27)	(5)
GSRP	235	109	7
(HBCU/MI)	(18)	(7)	(1)
HSAP	474	138	8
TOTAL	1281	435	54

4. SITE VISITS

During June and July of 1995, representatives of both AFOSR/NI and RDL visited each participating laboratory to provide briefings, answer questions, and resolve problems for both laboratory personnel and participants. The objective was to ensure that the SRP would be as constructive as possible for all participants. Both SRP participants and RDL representatives found these visits beneficial. At many of the laboratories, this was the only opportunity for all participants to meet at one time to share their experiences and exchange ideas.

5. HISTORICALLY BLACK COLLEGES AND UNIVERSITIES AND MINORITY INSTITUTIONS (HBCU/MIs)

Before 1993, an RDL program representative visited from seven to ten different HBCU/Mis annually to promote interest in the SRP among the faculty and graduate students. These efforts were marginally effective, yielding a doubling of HBCI/MI applicants. In an effort to achieve AFOSR's goal of 10% of all applicants and selectees being HBCU/MI qualified, the RDL team decided to try other avenues of approach to increase the number of qualified applicants. Through the combined efforts of the AFOSR Program Office at Bolling AFB and RDL, two very active minority groups were found, HACU (Hispanic American Colleges and Universities) and AISES (American Indian Science and Engineering Society). RDL is in communication with representatives of each of these organizations on a monthly basis to keep up with the their activities and special events. Both organizations have widely-distributed magazines/quarterlies in which RDL placed ads.

Since 1994 the number of both SFRP and GSRP HBCU/MI applicants and participants has increased ten-fold, from about two dozen SFRP applicants and a half dozen selectees to over 100 applicants and two dozen selectees, and a half-dozen GSRP applicants and two or three

selectees to 18 applicants and 7 or 8 selectees. The GSRP program remains the most difficult to increase the number of qualified applicants. Our research has indicated that significantly fewer minority students choose to pursue a higher degree than their counterparts.

In addition to RDL's special recruiting efforts, AFOSR attempts each year to obtain additional funding or use leftover funding from cancellations the past year to fund HBCU/MI associates. This year, 5 HBCU/MI SFRPs declined after they were selected (and there was no one qualified to replace them with). The following table records HBCU/MI participation in this program.

Table 3: SRP HBCU/MI Particiipation, by Year

YEAR	SFRP		GSRP	
	Applicants	Participants	Applicants	Participants
1985	76	23	15	11
1986	70	18	20	10
1987	82	32	32	10
1988	53	17	23	14
1989	39	15	13	4
1990	43	14	17	3
1991	42	13	8	5
1992	70	13	9	5
1993	60	13	6	2
1994	90	16	11	6
1995	90	21	20	8

6. SRP FUNDING SOURCES

Funding sources for the 1995 SRP were the AFOSR-provided slots for the basic contract and laboratory funds. Funding sources by category for the 1995 SRP selected participants are shown here.

Table 4: 1995 SRP Associate Funding

Funding Category	SFRP	GSRP	HSAP
AFOSR Basic Allocation Funds	141	85	123
USAF Laboratory Funds	37	19	15
HBCU/MI By AFOSR (Using Procured Addn'l Funds)	10	5	0
TOTAL	188	109	138

SFRP - 150 were selected, but nine canceled too late to be replaced.
GSRP - 90 were selected, but five canceled too late to be replaced (10 allocations for the ALCs were withheld by AFOSR.)
HSAP - 125 were selected, but two canceled too late to be replaced.

7. COMPENSATION FOR PARTICIPANTS

Compensation for SRP participants, per five-day work week, is shown in this table.

Table 5: 1995 SRP Associate Compensation

PARTICIPANT CATEGORY	1991	1992	1993	1994	1995
Faculty Members	$690	$718	$740	$740	$740
Graduate Student (Master's Degree)	$425	$442	$455	$455	$455
Graduate Student (Bachelor's Degree)	$365	$380	$391	$391	$391
High School Student (First Year)	$200	$200	$200	$200	$200
High School Student (Subsequent Years)	$240	$240	$240	$240	$240

The program also offered associates whose homes were more than 50 miles from the laboratory an expense allowance (seven days per week) of $50/day for faculty and $37/day for graduate students. Transportation to the laboratory at the beginning of their tour and back to their home destinations at the end was also reimbursed for these participants. Of the combined SFRP and

GSRP associates, 65 % (194 out of 297) claimed travel reimbursements at an average round-trip cost of $780.

Faculty members were encouraged to visit their laboratories before their summer tour began. All costs of these orientation visits were reimbursed. Forty-five percent (85 out of 188) of faculty associates took orientation trips at an average cost of $444. By contrast, in 1993, 58 % of SFRP associates took orientation visits at an average cost of $685; that was the highest percentage of associates opting to take an orientation trip since RDL has administered the SRP, and the highest average cost of an orientation trip. These 1993 numbers are included to show the fluctuation which can occur in these numbers for planning purposes.

Program participants submitted biweekly vouchers countersigned by their laboratory research focal point, and RDL issued paychecks so as to arrive in associates' hands two weeks later.

HSAP program participants were considered actual RDL employees, and their respective state and federal income tax and Social Security were withheld from their paychecks. By the nature of their independent research, SFRP and GSRP program participants were considered to be consultants or independent contractors. As such, SFRP and GSRP associates were responsible for their own income taxes, Social Security, and insurance.

8. CONTENTS OF THE 1995 REPORT

The complete set of reports for the 1995 SRP includes this program management report (Volume 1) augmented by fifteen volumes of final research reports by the 1995 associates, as indicated below:

Table 6: 1995 SRP Final Report Volume Assignments

LABORATORY	SFRP	GSRP	HSAP
Armstrong	2	7	12
Phillips	3	8	13
Rome	4	9	14
Wright	5A, 5B	10	15
AEDC, ALCs, WHMC	6	11	16

APPENDIX A -- PROGRAM STATISTICAL SUMMARY

A. Colleges/Universities Represented

Selected SFRP associates represented 169 different colleges, universities, and institutions, GSRP associates represented 95 different colleges, universities, and institutions.

B. States Represented

SFRP -Applicants came from 47 states plus Washington D.C. and Puerto Rico. Selectees represent 44 states plus Puerto Rico.

GSRP - Applicants came from 44 states and Puerto Rico. Selectees represent 32 states.

HSAP - Applicants came from thirteen states. Selectees represent nine states.

Table A-1. Total Participants

Total Number of Participants	
SFRP	188
GSRP	109
HSAP	138
TOTAL	435

Table A-2. Degrees Represented

Degrees Represented			
	SFRP	GSRP	TOTAL
Doctoral	184	1	185
Master's	4	48	52
Bachelor's	0	60	60
TOTAL	188	109	297

Table A-3. SFRP Academic Titles

Academic Titles	
Assistant Professor	79
Associate Professor	59
Professor	42
Instructor	3
Chairman	0
Visiting Professor	1
Visiting Assoc. Prof.	0
Research Associate	4
TOTAL	188

Table A-4. Source of Learning About SRP

SOURCE	Applicants	Selectees
Applied/participated in prior years	28%	34%
Colleague familiar with SRP	19%	16%
Brochure mailed to institution	23%	17%
Contact with Air Force laboratory	17%	23%
IEEE Spectrum	2%	1%
BIIHE	1%	1%
Other source	10%	8%
TOTAL	100%	100%

APPENDIX B -- SRP EVALUATION RESPONSES

1. OVERVIEW

Evaluations were completed and returned to RDL by four groups at the completion of the SRP. The number of respondents in each group is shown below.

Table B-1. Total SRP Evaluations Received

Evaluation Group	Responses
SFRP & GSRPs	275
HSAPs	113
USAF Laboratory Focal Points	84
USAF Laboratory HSAP Mentors	6

All groups indicate unanimous enthusiasm for the SRP experience.

Typical comments from 1995 SRP associates are:

Typical comments from laboratory focal points and mentors are:

The summarized recommendations for program improvement from both associates and laboratory personnel are listed below:

A. Better preparation on the labs' part prior to associates' arrival (i.e., office space, computer assets, clearly defined scope of work).

B. Faculty Associates suggest higher stipends for SFRP associates.

C. Both HSAP Air Force laboratory mentors and associates would like the summer tour extended from the current 8 weeks to either 10 or 11 weeks; the groups state it takes 4-6 weeks just to get high school students up-to-speed on what's going on at laboratory. (Note: this same argument was used to raise the faculty and graduate student participation time a few years ago.)

2. 1995 USAF LABORATORY FOCAL POINT (LFP) EVALUATION RESPONSES

The summarized results listed below are from the 84 LFP evaluations received.

1. LFP evaluations received and associate preferences:

Table B-2. Air Force LFP Evaluation Responses (By Type)

		How Many Associates Would You Prefer To Get ? (% Response)											
		SFRP				GSRP (w/Univ Professor)				GSRP (w/o Univ Professor)			
Lab	Evals Recv'd	0	1	2	3+	0	1	2	3+	0	1	2	3+
AEDC	0	-	-	-	-	-	-	-	-	-	-	-	-
WHMC	0	-	-	-	-	-	-	-	-	-	-	-	-
AL	7	28	28	28	14	54	14	28	0	86	0	14	0
FJSRL	1	0	100	0	0	100	0	0	0	0	100	0	0
PL	25	40	40	16	4	88	12	0	0	84	12	4	0
RL	5	60	40	0	0	80	10	0	0	100	0	0	0
WL	46	30	43	20	6	78	17	4	0	93	4	2	0
Total	84	32%	50%	13%	5%	80%	11%	6%	0%	73%	23%	4%	0%

LFP Evaluation Summary. The summarized responses, by laboratory, are listed on the following page. LFPs were asked to rate the following questions on a scale from 1 (below average) to 5 (above average).

2. LFPs involved in SRP associate application evaluation process:
   a. Time available for evaluation of applications:
   b. Adequacy of applications for selection process:
3. Value of orientation trips:
4. Length of research tour:
5. a. Benefits of associate's work to laboratory:
   b. Benefits of associate's work to Air Force:
6. a. Enhancement of research qualifications for LFP and staff:
   b. Enhancement of research qualifications for SFRP associate:
   c. Enhancement of research qualifications for GSRP associate:
7. a. Enhancement of knowledge for LFP and staff:
   b. Enhancement of knowledge for SFRP associate:
   c. Enhancement of knowledge for GSRP associate:
8. Value of Air Force and university links:
9. Potential for future collaboration:
10. a. Your working relationship with SFRP:
    b. Your working relationship with GSRP:
11. Expenditure of your time worthwhile:

(Continued on next page)

12. Quality of program literature for associate:
13. a. Quality of RDL's communications with you:
    b. Quality of RDL's communications with associates:
14. Overall assessment of SRP:

Table B-3. Laboratory Focal Point Reponses to above questions

	AEDC	*AL*	*FJSRL*	*PL*	*RL*	*WHMC*	*WL*
# Evals Recv'd	0	7	1	14	5	0	46
Question #							
2	-	86 %	0 %	88 %	80 %	-	85 %
2a	-	4.3	n/a	3.8	4.0	-	3.6
2b	-	4.0	n/a	3.9	4.5	-	4.1
3	-	4.5	n/a	4.3	4.3	-	3.7
4	-	4.1	4.0	4.1	4.2	-	3.9
5a	-	4.3	5.0	4.3	4.6	-	4.4
5b	-	4.5	n/a	4.2	4.6	-	4.3
6a	-	4.5	5.0	4.0	4.4	-	4.3
6b	-	4.3	n/a	4.1	5.0	-	4.4
6c	-	3.7	5.0	3.5	5.0	-	4.3
7a	-	4.7	5.0	4.0	4.4	-	4.3
7b	-	4.3	n/a	4.2	5.0	-	4.4
7c	-	4.0	5.0	3.9	5.0	-	4.3
8	-	4.6	4.0	4.5	4.6	-	4.3
9	-	4.9	5.0	4.4	4.8	-	4.2
10a	-	5.0	n/a	4.6	4.6	-	4.6
10b	-	4.7	5.0	3.9	5.0	-	4.4
11	-	4.6	5.0	4.4	4.8	-	4.4
12	-	4.0	4.0	4.0	4.2	-	3.8
13a	-	3.2	4.0	3.5	3.8	-	3.4
13b	-	3.4	4.0	3.6	4.5	-	3.6
14	-	4.4	5.0	4.4	4.8	-	4.4

3. 1995 SFRP & GSRP EVALUATION RESPONSES

The summarized results listed below are from the 257 SFRP/GSRP evaluations received.

Associates were asked to rate the following questions on a scale from 1 (below average) to 5 (above average) - by Air Force base results and over-all results of the 1996 evaluations are listed after the questions.

1. The match between the laboratories research and your field:
2. Your working relationship with your LFP:
3. Enhancement of your academic qualifications:
4. Enhancement of your research qualifications:
5. Lab readiness for you: LFP, task, plan:
6. Lab readiness for you: equipment, supplies, facilities:
7. Lab resources:
8. Lab research and administrative support:
9. Adequacy of brochure and associate handbook:
10. RDL communications with you:
11. Overall payment procedures:
12. Overall assessment of the SRP:
13. a. Would you apply again?
    b. Will you continue this or related research?
14. Was length of your tour satisfactory?
15. Percentage of associates who experienced difficulties in finding housing:
16. Where did you stay during your SRP tour?
    a. At Home:
    b. With Friend:
    c. On Local Economy:
    d. Base Quarters:
17. Value of orientation visit:
    a. Essential:
    b. Convenient:
    c. Not Worth Cost:
    d. Not Used:

SFRP and GSRP associate's responses are listed in tabular format on the following page.

Table B-4. 1995 SFRP & GSRP Associate Responses to SRP Evaluation

	Arnold	Brooks	Edwards	Eglin	Griffis	Hanscom	Kelly	Kirtland	Lackland	Robins	Tyndall	WPAFB	average
# res	6	48	6	14	31	19	3	32	1	2	10	85	257
1	4.8	4.4	4.6	4.7	4.4	4.9	4.6	4.6	5.0	5.0	4.0	4.7	4.6
2	5.0	4.6	4.1	4.9	4.7	4.7	5.0	4.7	5.0	5.0	4.6	4.8	4.7
3	4.5	4.4	4.0	4.6	4.3	4.2	4.3	4.4	5.0	5.0	4.5	4.3	4.4
4	4.3	4.5	3.8	4.6	4.4	4.4	4.3	4.6	5.0	4.0	4.4	4.5	4.5
5	4.5	4.3	3.3	4.8	4.4	4.5	4.3	4.2	5.0	5.0	3.9	4.4	4.4
6	4.3	4.3	3.7	4.7	4.4	4.5	4.0	3.8	5.0	5.0	3.8	4.2	4.2
7	4.5	4.4	4.2	4.8	4.5	4.3	4.3	4.1	5.0	5.0	4.3	4.3	4.4
8	4.5	4.6	3.0	4.9	4.4	4.3	4.3	4.5	5.0	5.0	4.7	4.5	4.5
9	4.7	4.5	4.7	4.5	4.3	4.5	4.7	4.3	5.0	5.0	4.1	4.5	4.5
10	4.2	4.4	4.7	4.4	4.1	4.1	4.0	4.2	5.0	4.5	3.6	4.4	4.3
11	3.8	4.1	4.5	4.0	3.9	4.1	4.0	4.0	3.0	4.0	3.7	4.0	4.0
12	5.7	4.7	4.3	4.9	4.5	4.9	4.7	4.6	5.0	4.5	4.6	4.5	4.6
Numbers below are percentages													
13a	83	90	83	93	87	75	100	81	100	100	100	86	87
13b	100	89	83	100	94	98	100	94	100	100	100	94	93
14	83	96	100	90	87	80	100	92	100	100	70	84	88
15	17	6	0	33	20	76	33	25	0	100	20	8	39
16a	-	26	17	9	38	23	33	4	-	-	-	30	
16b	100	33	-	40	-	8	-	-	-	-	36	2	
16c	-	41	83	40	62	69	67	96	100	100	64	68	
16d	-	-	-	-	-	-	-	-	-	-	-	0	
17a	-	33	100	17	50	14	67	39	-	50	40	31	35
17b	-	21	-	17	10	14	-	24	-	50	20	16	16
17c	-	-	-	-	10	7	-	-	-	-	-	2	3
17d	100	46	-	66	30	69	33	37	100	-	40	51	46

4. 1995 USAF LABORATORY HSAP MENTOR EVALUATION RESPONSES

Not enough evaluations received (5 total) from Mentors to do useful summary.

5. 1995 HSAP EVALUATION RESPONSES

The summarized results listed below are from the 113 HSAP evaluations received.

HSAP apprentices were asked to rate the following questions on a scale from
1 (below average) to 5 (above average)

1. Your influence on selection of topic/type of work.
2. Working relationship with mentor, other lab scientists.
3. Enhancement of your academic qualifications.
4. Technically challenging work.
5. Lab readiness for you: mentor, task, work plan, equipment.
6. Influence on your career.
7. Increased interest in math/science.
8. Lab research & administrative support.
9. Adequacy of RDL's Apprentice Handbook and administrative materials.
10. Responsiveness of RDL communications.
11. Overall payment procedures.
12. Overall assessment of SRP value to you.
13. Would you apply again next year? Yes (92 %)
14. Will you pursue future studies related to this research? Yes (68 %)
15. Was Tour length satisfactory? Yes (82 %)

	Arnold	Brooks	Edwards	Eglin	Griffiss	Hanscom	Kirtland	Tyndall	WPAFB	Totals
# resp	5	19	7	15	13	2	7	5	40	113
1	2.8	3.3	3.4	3.5	3.4	4.0	3.2	3.6	3.6	3.4
2	4.4	4.6	4.5	4.8	4.6	4.0	4.4	4.0	4.6	4.6
3	4.0	4.2	4.1	4.3	4.5	5.0	4.3	4.6	4.4	4.4
4	3.6	3.9	4.0	4.5	4.2	5.0	4.6	3.8	4.3	4.2
5	4.4	4.1	3.7	4.5	4.1	3.0	3.9	3.6	3.9	4.0
6	3.2	3.6	3.6	4.1	3.8	5.0	3.3	3.8	3.6	3.7
7	2.8	4.1	4.0	3.9	3.9	5.0	3.6	4.0	4.0	3.9
8	3.8	4.1	4.0	4.3	4.0	4.0	4.3	3.8	4.3	4.2
9	4.4	3.6	4.1	4.1	3.5	4.0	3.9	4.0	3.7	3.8
10	4.0	3.8	4.1	3.7	4.1	4.0	3.9	2.4	3.8	3.8
11	4.2	4.2	3.7	3.9	3.8	3.0	3.7	2.6	3.7	3.8
12	4.0	4.5	4.9	4.6	4.6	5.0	4.6	4.2	4.3	4.5
Numbers below are percentages										
13	60%	95%	100%	100%	85%	100%	100%	100%	90%	92%
14	20%	80%	71%	80%	54%	100%	71%	80%	65%	68%
15	100%	70%	71%	100%	100%	50%	86%	60%	80%	82%

SFRP Participant Data

Aalo, Valentine Assistant Professor, PhD Florida Atlantic University Boca Raton, FL 33431-0000	Field: Dept of Electrical Engr Laboratory: Rome Laboratory RL/C3 Vol-Page No: 4- 1
Aazhang, Behnaam Associate Professor, PhD Rice University Houston, TX 77251-1892	Field: Elec & Comp Engineering Laboratory: Phillips Laboratory PL/VT Vol-Page No: 3- 1
Ahmed, Saad Associate Professor, PhD King Fahd Univ of Petroleum & Saudia, - 0	Field: Aerospace Engineering Laboratory: Arnold Engineering Development AEDC/EA Vol-Page No: 6- 2
Allen, Gary Associate Professor, PhD University of South Carolina Columbia, SC 29208-0000	Field: Cognitive/Developmental Laboratory: Armstrong Laboratory AL/HR Vol-Page No: 2- 1
Allen-King, Richelle Assistant Professor, PhD Washington State University Pullman, WA 99164-2812	Field: Earth Sciences Laboratory: Armstrong Laboratory AL/EQ Vol-Page No: 2- 2
Baker, Suzanne Assistant Professor, PhD James Madison University Harrisonburg, VA 22807-0000	Field: Biological Psychology Laboratory: Armstrong Laboratory AL/OE Vol-Page No: 2- 3
Baldwin, James Assistant Professor, PhD University of Oklahoma Norman, OK 73019-0000	Field: Mechanical Engineering Laboratory: OC-ALC ALC/OC Vol-Page No: 6- 9
Bapty, Theodore Research Associate, PhD Vanderbilt University Nashville, TN 37235-0000	Field: Electrical Engineering Laboratory: Arnold Engineering Development AEDC/EA Vol-Page No: 6- 3
Barakat, Richard Research Associate, PhD Tufts University Medford, MA 2155-0000	Field: Electro Optics Laboratory: Rome Laboratory RL/ER Vol-Page No: 4- 2
Barrett, Ronald Assistant Professor, PhD Auburn University Auburn, AL 36849-5338	Field: Aerospace Engineering Laboratory: Wright Laboratory WL/MN Vol-Page No: 5- 1

SFRP Participant Data

Becus, Georges Associate Professor, PhD University of Cincinnati Cincinnati, OH 45221-0070	Field: Engineering Science Laboratory: Wright Laboratory WL/ML Vol-Page No: 5- 2
Beggs, John Assistant Professor, PhD Mississippi State University Mississippi State, MS 39762-0000	Field: Electrical Engineering Laboratory: Phillips Laboratory PL/WS Vol-Page No: 3- 2
Belen'kii, Mikhail Research Associate, PhD Georgia Tech Res Corp Atlanta, GA 30332-0000	Field: Philosophy Laboratory: Phillips Laboratory PL/LI Vol-Page No: 3- 3
Benjamin, David Assistant Professor, PhD Syracuse University Syracuse, NY 13244-4100	Field: Computer Science Laboratory: Rome Laboratory RL/C3 Vol-Page No: 4- 3
Bennett, Kevin Associate Professor, PhD Wright State University Dayton, OH 45435-0000	Field: Applied Experimental Psychology Laboratory: Armstrong Laboratory AL/CF Vol-Page No: 2- 4
Berdichevsky, Victor Professor, PhD Wayne State University Detroit, MI 48202-0000	Field: Solid Mechanics Laboratory: Wright Laboratory WL/FI Vol-Page No: 5- 3
Bhat, Gajanan Assistant Professor, PhD Univ of Tennessee Knoxville, TN 37996-0000	Field: Polymer Science Laboratory: Phillips Laboratory PL/RK Vol-Page No: 3- 4
Biddle, Verne Professor, PhD Bob Jones University Greenville, SC 29614-0000	Field: Analytical Chemistry Laboratory: Armstrong Laboratory AL/OE Vol-Page No: 2- 5
Biegl, Csaba Research Associate, PhD Vanderbilt University Nashville, TN 37235-0000	Field: Electrical Engineering Laboratory: Arnold Engineering Development AEDC/EA Vol-Page No: 6- 4
Blum, Ricky Assistant Professor, PhD Lehigh University Bethlehem, PA 18015-3084	Field: Electrical Engineering Laboratory: Rome Laboratory RL/OC Vol-Page No: 4- 4

SFRP Participant Data

Booker, Henry Professor, PhD Christopher Newport University Newport News, VA 23606-2998	Field: Economics/Finance Laboratory: Wright Laboratory WL/MT Vol-Page No: 5- 4
Bordetsky, Alexander Instructor, PhD California State University Hayward, CA 94542-0000	Field: Decision Sciences Laboratory: Armstrong Laboratory AL/HR Vol-Page No: 2- 6
Botros, Nazeih Associate Professor, PhD Southern Illinois U-Carbondale Carbondale, IL 62901-0000	Field: Electrical Engineering Laboratory: SA-ALC ALC/SA Vol-Page No: 6-15
Bukofzer, Daniel Professor, PhD Cal State Univ, Fresno Fresno, CA 93740-0094	Field: Electrical & Computer Engineering Laboratory: Phillips Laboratory PL/VT Vol-Page No: 3- 5
Cahay, Marc Assistant Professor, PhD University of Cincinnati Cincinnati, OH 45221-0000	Field: Electrical Engineering Laboratory: Wright Laboratory WL/EL Vol-Page No: 5- 5
Calo, Joseph Professor, PhD Brown University Providence, RI 2912-0000	Field: Chemical Engineering Laboratory: Phillips Laboratory PL/GP Vol-Page No: 3- 6
Carroll, James Assistant Professor, PhD Clarkson University Potsdam, NY 13699-5720	Field: Electrical Engineering Laboratory: WR-ALC ALC/WR Vol-Page No: 6-21
Carter, PhD, PA, Marc L. Assistant Professor, PhD University of South Florida Tampa, FL 33620-8200	Field: Experimental Psychology Laboratory: Armstrong Laboratory AL/OE Vol-Page No: 2- 7
Catrambone, Richard Assistant Professor, PhD Georgia Inst of Technology Atlanta, GA 30332-0170	Field: Experimental Psychology Laboratory: Armstrong Laboratory AL/HR Vol-Page No: 2- 8
Cefola, Paul Instructor, PhD Massachusetts Inst of Technology Cambridge, MA 2139-0000	Field: Mechanical Engineering Laboratory: Phillips Laboratory PL/VT Vol-Page No: 3- 7

SFRP Participant Data

Chang, Chia-Bo
Associate Professor, PhD
Texas Tech University
Lubbock, TX 79409-0000

Field: Geosciences/Atomospheric Science
Laboratory: Phillips Laboratory
PL/GP
Vol-Page No: 3- 8

Chapman, Gary
Associate Professor, PhD
Univ of Calif, Berkeley
Berkeley, CA 94720-0000

Field: Aerospace Engineering/Astronomy
Laboratory: Wright Laboratory
WL/MN
Vol-Page No: 5- 7

Chen, Pinyuen
Professor, PhD
Syracuse University
Syracuse, NY 13244-1150

Field: Statistics
Laboratory: Rome Laboratory
RL/OC
Vol-Page No: 4- 5

Cheung, Julian
Assistant Professor, PhD
New York Inst. of Technology
New York,, NY 10023-0000

Field: Electrical Engineering
Laboratory: Rome Laboratory
RL/IR
Vol-Page No: 4- 6

Chin, Der-Tau
Professor, PhD
Clarkson University
Potsdam, NY 13699-5705

Field: Chemical Engineering
Laboratory: Armstrong Laboratory
AL/EQ
Vol-Page No: 2- 9

Chinichian, Mostafa
Instructor, PhD
California Polytechnic State
San Luis Obispo, CA 93407-0000

Field:
Laboratory: Rome Laboratory
RL/C3
Vol-Page No: 4- 7

Chow, Joe
Associate Professor, PhD
Florida International University
Miami, FL 33199-0000

Field: Dept of Ind & Sys Eng
Laboratory: WR-ALC
ALC/WR
Vol-Page No: 6-21

Chubb, Gerald
Assistant Professor, PhD
Ohio State University
Columbus, OH 43210-1100

Field: Industrial Engineering
Laboratory: Armstrong Laboratory
AL/CF
Vol-Page No: 2-10

Clougherty, Dennis
Associate Professor, PhD
University of Vermont
Burlington, VT 5405-0125

Field: Physics
Laboratory: Rome Laboratory
RL/ER
Vol-Page No: 4- 8

Collins, Frank
Professor, PhD
Tennessee Univ Space Institute
Tullahoma, TN 37388-0000

Field: Mechanical Engineering
Laboratory: Arnold Engineering Development
AEDC/EA
Vol-Page No: 6- 5

SFRP Participant Data

Cone, Milton Assistant Professor, PhD Embry-Riddle Aeronautical Prescott, AZ 86303-0000	Field: Comp Science & Elec Eng Laboratory: Wright Laboratory WL/AA Vol-Page No: 5- 8
Das, Manohar Associate Professor, PhD Oakland University Rochester, MI 48309-4401	Field: Electrical Engineering Laboratory: Rome Laboratory RL/IR Vol-Page No: 4- 9
Davis, Stephen Associate Professor, PhD Mississippi State University Mississippi Sta, MS 39762-0000	Field: Mathematics Laboratory: Wright Laboratory WL/PO Vol-Page No: 5-10
DeAngelis, Robert Professor, PhD Univ of Nebraska - Lincoln Lincoln, NE 68588-0656	Field: Materials Science Laboratory: Wright Laboratory WL/MN Vol-Page No: 5-11
DeLyser, Ronald Assistant Professor, PhD University of Denver Denver, CO 80208-0177	Field: Electrical Engineering Laboratory: Phillips Laboratory PL/WS Vol-Page No: 3- 9
Diels, Jean-Claude Professor, PhD University of New Mexico Albuquerque, NM 87131-0000	Field: Physics Laboratory: Phillips Laboratory PL/LI Vol-Page No: 3-10
Ding, Yujie Assistant Professor, PhD Bowling Green State University Bowling Green, OH 43403-0000	Field: Nonlinear Optics, Laboratory: Wright Laboratory WL/EL Vol-Page No: 5-12
Dolson, David Associate Professor, PhD Wright State University Dayton, OH 45435-0000	Field: Chemistry Laboratory: Wright Laboratory WL/PO Vol-Page No: 5-13
Dominic, Vincent Assistant Professor, PhD University of Dayton Dayton, OH 45469-0000	Field: Electrical Laboratory: Wright Laboratory WL/ML Vol-Page No: 5-14
Dotan, Itzhak Professor, PhD The Open University of Israel Tel-Aviv, IS - 0	Field: Chemistry Laboratory: Phillips Laboratory PL/GP Vol-Page No: 3-11

SFRP Participant Data

Drost-Hansen, Walter Professor, PhD University of Miami Coral Gables, FL 33124-0000	Field: Chemistry Laboratory: Wilfred Hall Medical Center WHMC/WH Vol-Page No: 6-23
Dutta, Indranath Associate Professor, PhD Naval Postgraduate School Monterey, CA 93943-0000	Field: Materials Science & Engineerin Laboratory: Wright Laboratory WL/ML Vol-Page No: 5-15
Ervin, Elizabeth Visiting Associate Prof., PhD University of Dayton Dayton, OH 45469-0000	Field: Mechanical Engineering Laboratory: Wright Laboratory WL/PO Vol-Page No: 5-16
Ewert, Daniel Assistant Professor, PhD North Dakota State University Grand Forks, ND 85105-0000	Field: Physiology Laboratory: Armstrong Laboratory AL/AO Vol-Page No: 2-12
Fleischman, Marvin Professor, PhD University of Louisville Louisville, KY 40292-0000	Field: Chemical Engineering Laboratory: OO-ALC ALC/OO Vol-Page No: 6-12
Ford, Roger Associate Professor, PhD St. Mary's Univ of San Antonio San Antonio, TX 78228-8534	Field: Industrial Engineering Laboratory: SA-ALC ALC/SA Vol-Page No: 6-16
Friedman, Jeffrey Assistant Professor, PhD University of Puerto Rico Mayaguez, PR 681-5000	Field: Physics Laboratory: Phillips Laboratory PL/LI Vol-Page No: 3-12
Gao, Zhanjun Assistant Professor, PhD Clarkson University Potsdam, NY 13699-5725	Field: Mech & Aeronautical Eng. Laboratory: Wright Laboratory WL/ML Vol-Page No: 5-17
Gerth, Richard Assistant Professor, PhD Ohio University Athens, OH 45701-0000	Field: Industrial Engineering Laboratory: Wright Laboratory WL/MT Vol-Page No: 5-18
Giannamore, Vincent Assistant Professor, PhD Xavier University of Louisiana New Orleans, LA 70125-0000	Field: Chemistry Laboratory: Phillips Laboratory PL/RK Vol-Page No: 3-13

SFRP Participant Data

Glickman-Weiss, Ellen
Assistant Professor, PhD
Louisiana State University
Baton Rouge, LA 70803-0000

Field: Exercise Physiology
Laboratory: Armstrong Laboratory
AL/CF
Vol-Page No: 2-13

Glover, James
Associate Professor, PhD
Langston University
Langston, OK 73050-0000

Field: Mathematics
Laboratory: SM-ALC
ALC/SM
Vol-Page No: 6-18

Gould, Richard
Associate Professor, PhD
North Carolina State U-Raleigh
Raleigh, NC 27695-7910

Field: Mechanical Engineering
Laboratory: Wright Laboratory
WL/PO
Vol-Page No: 5-19

Grady, Brian
Assistant Professor, PhD
University of Oklahoma
Norman, OK 73019-0628

Field: Chemical Engineering
Laboratory: OC-ALC
ALC/OC
Vol-Page No: 6-10

Grinfeld, Michael
Professor, PhD
Rutgers University, Piscataway
Piscataway, NJ 8855-0909

Field: Mechanical Engineering
Laboratory: Wright Laboratory
WL/FI
Vol-Page No: 5-20

Gu, Guoxiang
Assistant Professor, PhD
Louisiana State University
Baton Rouge, LA 70803-5901

Field: Electrical Engineering
Laboratory: Wright Laboratory
WL/FI
Vol-Page No: 5-21

Guthrie, John
Assistant Professor, PhD
University of Central Oklahoma
Edmond, OK 73034-0000

Field: Physics
Laboratory: Phillips Laboratory
PL/LI
Vol-Page No: 3-14

Guttenplan, Joseph
Professor, PhD
New York Univ Dental/Medical
New York, NY 10010-0000

Field: Chemistry
Laboratory: Armstrong Laboratory
AL/OE
Vol-Page No: 2-14

Hakkinen, Raimo
Professor, PhD
Washington University
Saint Louis, MO 63131-4899

Field: Aeronautics
Laboratory: Wright Laboratory
WL/FI
Vol-Page No: 5-22

Haus, Joseph
Associate Professor, PhD
Rensselaer Polytechnic
Troy, NY 12180-3590

Field: Physics
Laboratory: Rome Laboratory
RL/OC
Vol-Page No: 4-10

SFRP Participant Data

Helmick, Larry
Professor, PhD
Cedarville College
Cedarville, OH 45314-0601

Field: Chemistry
Laboratory: Wright Laboratory
WL/ML
Vol-Page No: 5-23

ISU VPP Acct 4212313 (Dooley),
Assistant Professor, PhD
Iowa State University
Ames, IA 50011-0000

Field: Philosophy & Physiology
Laboratory: Armstrong Laboratory
AL/OE
Vol-Page No: 2-11

Johnson, David
Associate Professor, PhD
University of Dayton
Dayton, OH 45469-2357

Field: Chemistry
Laboratory: Wright Laboratory
WL/ML
Vol-Page No: 5-24

Johnson, Glenda
Assistant Professor, PhD
Dillard University
New Orleans, LA 70122-0000

Field: Human Nutrition
Laboratory: Armstrong Laboratory
AL/PS
Vol-Page No: 2-15

Joshi, Ravindra
Assistant Professor, PhD
Old Dominion University
Norfolk, VA 23529-0246

Field: Electrical & Computer Engineeri
Laboratory: Phillips Laboratory
PL/WS
Vol-Page No: 3-15

Kad, Bimal
Research Associate, PhD
University of Calif - San Diego
San Diego, CA 92093-0000

Field: Applied Mathematics/Engineering
Laboratory: Wright Laboratory
WL/ML
Vol-Page No: 5-25

Kalluri, Dikshitulu
Professor, PhD
University of Lowell
Lowell, MA 1854-0000

Field: Electrical Engineering
Laboratory: Phillips Laboratory
PL/GP
Vol-Page No: 3-16

Kaluarachichi, Jagath
Assistant Professor, PhD
Utah State University
Logan, UT 84322-8200

Field: Civil Engineering
Laboratory: OO-ALC
ALC/OO
Vol-Page No: 6-13

Kar, Aravinda
Assistant Professor, PhD
University of Central Florida
Orlando, FL 32826-0000

Field: Engineering
Laboratory: Phillips Laboratory
PL/LI
Vol-Page No: 3-17

Kazimierczuk, Marian
Professor, PhD
Wright State University
Dayton, OH 45435-0000

Field: Electrical Engineering
Laboratory: Wright Laboratory
WL/PO
Vol-Page No: 5-26

Kenney III, John Associate Professor, PhD Eastern New Mexico Univ Portales, NM 88130-0000	Field: Physical Chemistry Laboratory: Phillips Laboratory PL/RK Vol-Page No: 3-18
Kirkici, Hulya Assistant Professor, PhD Auburn University Auburn, AL 36849-5201	Field: Electrical Engineering Laboratory: Phillips Laboratory PL/WS Vol-Page No: 3-19
Koch, Manfred Associate Professor, PhD Florida State University Tallahassee, FL 32306-0000	Field: Geophysics Laboratory: Armstrong Laboratory AL/EQ Vol-Page No: 2-16
Koivo, Antti Professor, PhD Purdue University West Lafayette, IN 47907-1285	Field: Automatic Controls Laboratory: Wright Laboratory WL/FI Vol-Page No: 5-27
Kornreich, Phillip Professor, PhD Syracuse University Syracuse, NY 13244-1150	Field: Electrical Engineering Laboratory: Rome Laboratory RL/OC Vol-Page No: 4-11
Krile, Thomas Professor, PhD Texas Tech University Lubbock, TX 79409-0000	Field: Electrical Engineering Laboratory: Phillips Laboratory PL/LI Vol-Page No: 3-20
Krishnamurthy, L. Professor, PhD Florida Inst of Technology Melbourne, FL 32901-6988	Field: Engineering Sciences Laboratory: Armstrong Laboratory AL/EQ Vol-Page No: 2-17
Kuklinski, Walter Associate Professor, PhD University of Lowell Lowell, MA 1854-0000	Field: Electrical Engineering Laboratory: Phillips Laboratory PL/GP Vol-Page No: 3-21
Kulkarni, Pandurang Associate Professor, PhD University of South Alabama Mobile, AL 36688-0000	Field: Statistics Laboratory: Armstrong Laboratory AL/AO Vol-Page No: 2-18
Kuo, Spencer Professor, PhD Polytechnic Inst of New York Brooklyn, NY 11201-0000	Field: ElectroPhysics Laboratory: Phillips Laboratory PL/GP Vol-Page No: 3-22

Labare, Michael
Assistant Professor, PhD
Mount Saint Mary College
Newburgh, NY 12550-0000

Field: Marine Estuarine Sciences
Laboratory: Armstrong Laboratory
AL/EQ
Vol-Page No: 2-19

Lavine, Barry
Associate Professor, PhD
Clarkson University
Potsdam, NY 13699-5810

Field: Chemistry
Laboratory: Armstrong Laboratory
AL/EQ
Vol-Page No: 2-20

Lawless, Brother
Professor, PhD
Fordham University
New York, NY 10021-0000

Field: Science & Mathematics
Laboratory: Armstrong Laboratory
AL/AO
Vol-Page No: 2-21

Lee, Andre
Assistant Professor, PhD
Michigan State University
East Lansing, MI 48824-0000

Field: Physics
Laboratory: Wright Laboratory
WL/ML
Vol-Page No: 5-28

Lee, Tzesan
Associate Professor, PhD
Western Illinois University
Macomb, IL 61455-0000

Field: Mathematics
Laboratory: Armstrong Laboratory
AL/OE
Vol-Page No: 2-22

Lieh, Junghsen
Assistant Professor, PhD
Wright State University
Dayton, OH 45435-0000

Field: Mechanical Engineering
Laboratory: Wright Laboratory
WL/FI
Vol-Page No: 5-29

Lin, Chun-Shin
Associate Professor, PhD
Univ of Missouri-Columbi
Columbia, MO 65211-0000

Field: Electrical Engineering
Laboratory: Wright Laboratory
WL/FI
Vol-Page No: 5-30

Lin, Kuo-Chi
Research Associate, PhD
University of Central Florida
Orlando, FL 32826-0000

Field: Aerospace Engineering
Laboratory: Wright Laboratory
WL/AA
Vol-Page No: 5-31

Lin, Paul
Associate Professor, PhD
Cleveland State University
Cleveland, OH 44115-0000

Field: Mechanical Engineering
Laboratory: Wright Laboratory
WL/FI
Vol-Page No: 5-32

Lodhi, M. Arfin
Professor, PhD
Texas Tech University
Lubbock, TX 79409-1051

Field: Nuclear Physics
Laboratory: Phillips Laboratory
PL/VT
Vol-Page No: 3-23

Logendran, Rasaratnam Associate Professor, PhD Oregon State University Corvallis, OR 97331-2407	Field: Industrial Engineering Laboratory: SM-ALC ALC/SM Vol-Page No: 6-19
Lu, Christopher Associate Professor, PhD University of Dayton Dayton, OH 45469-0246	Field: Chemical Engineering Laboratory: Wright Laboratory WL/PO Vol-Page No: 5-33
Ludwig, David Associate Professor, PhD Univ of N.C. at Greensboro Greensboro, NC 27412-0000	Field: Applied Statistics Laboratory: Armstrong Laboratory AL/AO Vol-Page No: 2-23
Madler, Ronald Assistant Professor, PhD Embry-Riddle Aeronautical Prescott, AZ 86301-3720	Field: Aerospace Engineering Laboratory: Phillips Laboratory PL/WS Vol-Page No: 3-24
Mahan, Robert Associate Professor, PhD University of Georgia Athens, GA 30602-0000	Field: Applied Cognitive Psychology Laboratory: Armstrong Laboratory AL/CF Vol-Page No: 2-24
Maji, Arup Associate Professor, PhD University of New Mexico Albuquerque, NM 87131-0000	Field: Structural Engineering/Mechanics Laboratory: Phillips Laboratory PL/VT Vol-Page No: 3-25
Marsh, James Professor, PhD University of West Florida Pensacola, FL 32514-0000	Field: Physics Laboratory: Wright Laboratory WL/MN Vol-Page No: 5-34
Marshall, Paul Associate Professor, PhD University of North Texas Denton, TX 76203-0396	Field: Chemistry Laboratory: Wright Laboratory WL/ML Vol-Page No: 5-35
Martin, David Assistant Professor, PhD Univ of Michigan Ann Arbor, MI 48109-2136	Field: Polymer Science Laboratory: Phillips Laboratory PL/RK Vol-Page No: 3-26
Masi, James Professor, PhD Western New England College Springfield, MA 1119-0000	Field: Applied Sciences Laboratory: Rome Laboratory RL/ER Vol-Page No: 4-12

SFRP Participant Data

Mason, James
Assistant Professor, PhD
University of Notre Dame
Notre Dame, IN 46556-5637

Field: Applied Mechanics
Laboratory: Wright Laboratory
WL/MN
Vol-Page No: 5-36

Massopust, Peter
Visiting Professor, PhD
Sam Houston State University
Huntsville, TX 77341-0000

Field: Mathematics
Laboratory: Arnold Engineering Development
AEDC/EA
Vol-Page No: 6- 6

Mattson, Patrick
Assistant Professor, MS
St. Cloud State University
St Cloud, MN 56301-4498

Field: Administration
Laboratory: Armstrong Laboratory
AL/HR
Vol-Page No: 2-25

McAlister, Sandra
Associate Professor, PhD
Stonehill College
North Easton, MA 2357-0000

Field: Biology
Laboratory: Armstrong Laboratory
AL/AO
Vol-Page No: 2-26

Mehrotra, Rajiv
Associate Professor, PhD
Univ of Missouri - St. Louis
St Louis, MO 63121-4499

Field: Computer Science
Laboratory: Wright Laboratory
WL/AA
Vol-Page No: 5-37

Mendenhall, George
Professor, PhD
Michigan Technological University
Houghton, MI 49931-0000

Field: Chemistry
Laboratory: Phillips Laboratory
PL/RK
Vol-Page No: 3-27

Migliuolo, Stefano
Research Associate, PhD
Massachusetts Inst of Technology
Cambridge, MA 2139-0000

Field: Plasma Physics
Laboratory: Phillips Laboratory
PL/GP
Vol-Page No: 3-28

Miller, Douglas
Associate Professor, PhD
Cedarville College
Cedarville, OH 45314-0601

Field: Chemistry
Laboratory: Wright Laboratory
WL/ML
Vol-Page No: 5-38

Mukherjee, Sarit
Assistant Professor, PhD
University of Nebraska/Lincoln
Lincoln, NE 68588-0115

Field: Computer Science & Engineering
Laboratory: Wright Laboratory
WL/AA
Vol-Page No: 5-39

Musicant, Alan
, PhD
Middle Tennessee State Univ
Murfreesbord, TN 37132-0000

Field: Behavioral Science
Laboratory: Armstrong Laboratory
AL/CF
Vol-Page No: 2-27

SFRP Participant Data

Naishadham, Krishna Associate Professor, PhD Wright State University Dayton, OH 45435-0000	Field: Electrical Engineering Laboratory: Wright Laboratory WL/ML Vol-Page No: 5-40
Newman, Timothy Assistant Professor, PhD Univ of Alabama at Huntsville Huntsville, AL 35899-0000	Field: Computer Science Laboratory: Rome Laboratory RL/IR Vol-Page No: 4-13
Noel, Charles Associate Professor, PhD Ohio State University Columbus, OH 43210-1295	Field: Chemistry Laboratory: Phillips Laboratory PL/RK Vol-Page No: 3-29
Norgard, John Professor, PhD Univ of Colorado at Colorado Colorado Spring, CO 80933-7150	Field: Electrical Engineering Laboratory: Rome Laboratory RL/ER Vol-Page No: 4-14
Ordonez, Carlos Assistant Professor, PhD Univ of Texas at Denton Denton, TX 76203-0368	Field: Physics Laboratory: Phillips Laboratory PL/WS Vol-Page No: 3-30
Pangia, Michael Assistant Professor, PhD Georgia Southwestern College Americus, GA 31709-4693	Field: Physics Laboratory: Phillips Laboratory PL/GP Vol-Page No: 3-31
Penno, Robert Assistant Professor, PhD University of Dayton Dayton, OH 45469-0226	Field: Electrical Engineering Laboratory: Wright Laboratory WL/AA Vol-Page No: 5-41
Pickett, Ronald Professor, PhD University of Lowell Lowell, MA 1854-0000	Field: Experimental Psychology Laboratory: Phillips Laboratory PL/GP Vol-Page No: 3-32
Piepmeier, Edward Assistant Professor, PhD University of South Carolina Columbia, SC 29208-0000	Field: Pharmaceutics Laboratory: Armstrong Laboratory AL/AO Vol-Page No: 2-28
Pittarelli, Michael Associate Professor, PhD SUNY OF Tech Utica Utica, NY 13504-3050	Field: Systems Science Laboratory: Rome Laboratory RL/C3 Vol-Page No: 4-15

SFRP Participant Data

Poulikakos, Dimos
Professor, PhD
Univ of Illinois at Chicago
Chicago, IL 60607-7022

Field: Mechanical Engineering
Laboratory: Phillips Laboratory
PL/RK
Vol-Page No: 3-33

Powers, Joseph
Assistant Professor, PhD
University of Notre Dame
Notre Dame, IN 46556-5637

Field: Mechanical Engineering
Laboratory: Wright Laboratory
WL/MN
Vol-Page No: 5-42

Price, Randel
Assistant Professor, PhD
The University of Mississippi
University, MS 38677-9740

Field: Chemical Engineering
Laboratory: Armstrong Laboratory
AL/CF
Vol-Page No: 2-29

Purtill, Mark
Assistant Professor, PhD
Texas A & M Univ-Kingsville
Kingsville, TX 78363-0000

Field: Mathematics
Laboratory: Phillips Laboratory
PL/WS
Vol-Page No: 3-34

Qu, Zhihua
Assistant Professor, PhD
University of Central Florida
Orlando, FL 32816-0000

Field: Systems & Controls
Laboratory: Wright Laboratory
WL/MN
Vol-Page No: 5-43

Rahaman, Mohamed
Professor, PhD
Univ of Missouri - Rolla
Rolla, MO 65401-0249

Field: Materials Science
Laboratory: Wright Laboratory
WL/ML
Vol-Page No: 5-44

Reffell, Massala
Assistant Professor, MS
Prairie View A and M University
Prairie View, TX 77446-0308

Field: Electrical Engineering
Laboratory: Rome Laboratory
RL/C3
Vol-Page No: 4-16

Rengarajan, Sembiam
Professor, PhD
Cal State Univ, Northridge
Northridge, CA 91330-8346

Field: Electrical Engineering
Laboratory: Rome Laboratory
RL/ER
Vol-Page No: 4-17

Retzlaff, Paul
Associate Professor, PhD
Univ of Northern Colorado
Greeley, CO 80639-0000

Field: Psychology
Laboratory: Armstrong Laboratory
AL/AO
Vol-Page No: 2-30

Richardson, Dean
Assistant Professor, PhD
SUNY OF Tech Utica
Utica, NY 13504-3050

Field: Optical Sciences
Laboratory: Rome Laboratory
RL/OC
Vol-Page No: 4-18

Rizki, Mateen
Associate Professor, PhD
Wright State University
Dayton, OH 45435-0000

Field: Computer Science
Laboratory: Wright Laboratory
WL/AA
Vol-Page No: 5-45

Roach, Robert
Assistant Professor, PhD
Tennessee Univ Space Institute
Tullahoma, TN 37388-0000

Field: Aerospace Engineering
Laboratory: Arnold Engineering Development
AEDC/EA
Vol-Page No: 6- 7

Rong, Yiming
Assistant Professor, PhD
Southern Illinois U-Carbondale
Carbondale, IL 62901-0000

Field: Mechanical Engineering
Laboratory: Wright Laboratory
WL/ML
Vol-Page No: 5-46

Rubin, Stuart
Assistant Professor, PhD
Central Michigan University
Mt. Pleasant, MI 48859-0000

Field: Computer Science
Laboratory: Wright Laboratory
WL/AA
Vol-Page No: 5-47

Rudolph, Wolfgang
Associate Professor, PhD
University of New Mexico
Albuquerque, NM 84131-0000

Field: Physics
Laboratory: Phillips Laboratory
PL/LI
Vol-Page No: 3-35

Sadegh, Ali
Chairman, PhD
CUNY-City College
New York, NY 10031-0000

Field: Mechanics
Laboratory: Armstrong Laboratory
AL/CF
Vol-Page No: 2-31

Sales, Gary
Associate Professor, PhD
University of Lowell
Lowell, MA 1854-0000

Field: Physics
Laboratory: Phillips Laboratory
PL/GP
Vol-Page No: 3-36

Schmalzel, John
Associate Professor, PhD
Rowan College of New Jersey
Glassboro, NJ 8028-1701

Field: Engineering
Laboratory: Wright Laboratory
WL/AA
Vol-Page No: 5-48

Schulz, William
Professor, PhD
Eastern Kentucky University
Richmond, KY 40475-0000

Field: Chemistry
Laboratory: Wright Laboratory
WL/PO
Vol-Page No: 5-49

Selvavel, Kandasamy
Assistant Professor, PhD
Claflin College
Orangeburg, SC 29115-0000

Field: Mathematics & Statistics
Laboratory: Armstrong Laboratory
AL/AO
Vol-Page No: 2-32

Serpen, Gursel
Associate Professor, PhD
The University of Toledo
Toledo, OH 43606-0000

Field: Dept of Elect Eng & Comp Science
Laboratory: OO-ALC
ALC/OO
Vol-Page No: 6-14

Sherman, Larry
Professor, PhD
Univ of Scranton
Scranton, PA 18510-4626

Field: Analytical Chemistry
Laboratory: Armstrong Laboratory
AL/AO
Vol-Page No: 2-33

Shih, Frank
Professor, PhD
New Jersey Inst of Technology
Newark, NJ 7102-0000

Field: Computer/Information Science
Laboratory: Rome Laboratory
RL/IR
Vol-Page No: 4-19

Shoemaker, Melani
Instructor, PhD
Seattle Pacific University
Seattle, WA 98119-0000

Field: Electrical Engineering
Laboratory: Phillips Laboratory
PL/LI
Vol-Page No: 3-37

Slater, Joseph
Assistant Professor, PhD
Wright State University
Dayton, OH 45435-0000

Field: Dynamics & Control
Laboratory: Wright Laboratory
WL/FI
Vol-Page No: 5-50

Smith, Jeffrey
Associate Professor, PhD
University of Georgia
Athens, GA 30602-0000

Field: Electrical Engineering
Laboratory: Rome Laboratory
RL/IR
Vol-Page No: 4-20

Spetka, Scott
Assistant Professor, PhD
SUNY OF Tech Utica
Utica, NY 13504-3050

Field: Computer Science
Laboratory: Rome Laboratory
RL/C3
Vol-Page No: 4-21

Stauffer, Joseph
Instructor, MS
Indiana State University
Terre Haute, IN 47809-0000

Field: Management
Laboratory: Armstrong Laboratory
AL/HR
Vol-Page No: 2-34

Stavinoha, William
Professor, PhD
Univ of Texas Health Science
San Antonio, TX 78284-7764

Field: Pharmacology
Laboratory: Armstrong Laboratory
AL/CF
Vol-Page No: 2-35

Steckl, Andrew
Professor, PhD
University of Cincinnati
Cincinnati, OH 45221-0030

Field: Electrical and Computer
Laboratory: Wright Laboratory
WL/ML
Vol-Page No: 5-51

SFRP Participant Data

Stilman, Boris Professor, PhD Univ of Colòrado at Denver Denver, CO 80217-3364	Field: Computer Science Laboratory: Phillips Laboratory PL/VT Vol-Page No: 3-38
Stuart, John Associate Professor, PhD Wiley College Marshall, TX 75670-0000	Field: Organic Chemistry Laboratory: Armstrong Laboratory AL/AO Vol-Page No: 2-36
Sun, Gang Assistant Professor, PhD Univ of Massachusetts - Boston Boston, MA 2125-3393	Field: Physics Laboratory: Rome Laboratory RL/ER Vol-Page No: 4-22
Sundareshan, Malur Professor, PhD University of Arizona Tucson, AZ 85721-0000	Field: Electrical and Computer Laboratory: Wright Laboratory WL/MN Vol-Page No: 5-52
Tague, John Associate Professor, PhD Ohio University Athens, OH 45701-0000	Field: Electrical Engineering Laboratory: Wright Laboratory WL/AA Vol-Page No: 5-53
Tang, Jinke Associate Professor, PhD University of New Orleans New Orleans, LA 70148-0000	Field: Physics Laboratory: Wright Laboratory WL/ML Vol-Page No: 5-54
Tarvin, John Associate Professor, PhD Samford University Birmingham, AL 35229-0000	Field: Department of Physics Laboratory: Arnold Engineering Development AEDC/EA Vol-Page No: 6- 8
Taylor, Barney Visiting Assist Professor, PhD Miami Univ. - Hamilton Hamilton, OH 45011-0000	Field: Physics Laboratory: Wright Laboratory WL/ML Vol-Page No: 5-55
Tedesco, Joseph Professor, PhD Auburn University Auburn, AL 36849-0000	Field: Civil Engineering Laboratory: Wright Laboratory WL/MN Vol-Page No: 5-56
Thirunarayan, Krishnaprasad Assistant Professor, PhD Wright State University Dayton, OH 45435-0000	Field: Computer Science Laboratory: Wright Laboratory WL/EL Vol-Page No: 5-57

Thomas, Scott
Assistant Professor, PhD
Wright State University
Dayton, OH 45435-0000

Field: Mechanical Engineering
Laboratory: Wright Laboratory
WL/PO
Vol-Page No: 5-58

Tripathy, Ram
Professor, PhD
Univ of Texas at San Antonio
San Antonio, TX 78249-0000

Field: Statistics
Laboratory: Armstrong Laboratory
AL/AO
Vol-Page No: 2-37

Truhon, Stephen
Associate Professor, PhD
Winston-Salem State University
Winston-Salem, NC 27110-0000

Field: Psychology
Laboratory: Armstrong Laboratory
AL/HR
Vol-Page No: 2-38

Tsai, Chi-Tay
Associate Professor, PhD
Florida Atlantic University
Boca Raton, FL 33431-0991

Field: Engineering Mechanics
Laboratory: Wright Laboratory
WL/MN
Vol-Page No: 5-59

Tsukruk, Vladimir
Associate Professor, PhD
Western Michigan University
Kalamazoo, MI 49008-0000

Field: Physics
Laboratory: Wright Laboratory
WL/ML
Vol-Page No: 5-60

Tzou, Horn-Sen
Associate Professor, PhD
University of Kentucky
Lexington, KY 40506-0046

Field: Mechanical Engineering
Laboratory: Wright Laboratory
WL/FI
Vol-Page No: 5-61

Vallabha, Sailaja
Instructor, MS
Fayetteville State Univ
Fayetteville, NC 28301-4298

Field: Analytical Chemistry
Laboratory: Armstrong Laboratory
AL/OE
Vol-Page No: 2-39

VanDeMark, Michael
Associate Professor, PhD
Univ of Missouri - Rolla
Rolla, MO 65401-0000

Field: Chemistry
Laboratory: OC-ALC
ALC/OC
Vol-Page No: 6-11

Vogt, Brian
Professor, PhD
Bob Jones University
Greenville, SC 29614-0000

Field: Chemistry
Laboratory: Armstrong Laboratory
AL/EQ
Vol-Page No: 2-40

Wang, Jun
Associate Professor, PhD
University of North Dakota
Grand Forks, ND 58202-7118

Field: Systems Engineering
Laboratory: Armstrong Laboratory
AL/HR
Vol-Page No: 2-41

Watt, David Associate Professor, PhD University of New Hampshire Durham, NH 3824-0000	Field: Mechanical Engineering Laboratory: Phillips Laboratory PL/GP Vol-Page No: 3-39
West, James Associate Professor, PhD Oklahoma State University Stillwater, OK 74078-0000	Field: Electrical Engineering Laboratory: Rome Laboratory RL/ER Vol-Page No: 4-23
Wise, William Assistant Professor, PhD University of Florida Gainesville, FL 32611-0000	Field: Dept. of Civil Engineering Laboratory: Armstrong Laboratory AL/EQ Vol-Page No: 2-42
Woehr, David Assistant Professor, PhD Texas A & M Univ-College Station College Station, TX 77843-4235	Field: Department of Psychology Laboratory: Armstrong Laboratory AL/HR Vol-Page No: 2-43
Wolfe, Michael Assistant Professor, PhD West Virginia University Morgantown, WV 26506-0000	Field: Management Science Laboratory: SA-ALC ALC/SA Vol-Page No: 6-17
Wolfe, William Associate Professor, PhD Univ of Colorado at Denver Denver, CO 80217-3364	Field: Mathematics Laboratory: Wright Laboratory WL/MT Vol-Page No: 5-62
Wu, Peter Associate Professor, PhD Southern Oregon State College Ashland, OR 97520-0000	Field: Physics Laboratory: Rome Laboratory RL/ER Vol-Page No: 4-24
Young, Jeffrey Assistant Professor, PhD University of Idaho Moscow, ID 83844-1023	Field: Electrical Engineering Laboratory: Wright Laboratory WL/FI Vol-Page No: 5-63
Zhou, Norman Assistant Professor, PhD University of Wisconsin-Stout Menomonie, WI 54751-0000	Field: Technology Department Laboratory: SM-ALC ALC/SM Vol-Page No: 6-20
Zhu, Jianchao (Jim) Assistant Professor, PhD LSU Agri/Mech College Baton Rouge, LA 70803-0000	Field: Electrical Engineering Laboratory: Wright Laboratory WL/MN Vol-Page No: 5-64

GSRP Participant Data

Afshar, Vala BS University of Lowell Lowell, MA 1854-0000	Field: Electrical Engineering Laboratory: Phillips Laboratory PL/GP Vol-Page No: 8- 1
Akos, Dennis MS Ohio University Athens, OH 45701-0000	Field: Electrical & Computer Engineering Laboratory: Wright Laboratory WL/AA Vol-Page No: 10- 1
Anderson, Thomas MS University of Connecticut Storrs, CT 6269-0000	Field: Seismology Laboratory: Phillips Laboratory PL/GP Vol-Page No: 8- 2
Barnes, Raymond MS Binghamton University Binghamton, NY 13902-0000	Field: Agricultural Economics Laboratory: Rome Laboratory RL/IR Vol-Page No: 9- 1
Bennett, Paul MA University of New Mexico Albuquerque, NM 87131-0000	Field: Applied Mathematics Laboratory: Phillips Laboratory PL/LI Vol-Page No: 8- 3
Bernard, Wesley BS University of Dayton Dayton, OH 45469-0227	Field: Physics Laboratory: Wright Laboratory WL/AA Vol-Page No: 10- 2
Bias, David MS Oklahoma State University Stillwater, OK 74078-0000	Field: Higher Education Laboratory: Wright Laboratory WL/MT Vol-Page No: 10- 3
Birkhahn, Ronald MS University of Cincinnati Cincinnati, OH 45221-0012	Field: Materials Science Laboratory: Wright Laboratory WL/ML Vol-Page No: 10- 4
Blair, Jason BS Wright State University Dayton, OH 45435-0000	Field: Mechanical Engineering Laboratory: Wright Laboratory WL/FI Vol-Page No: 10- 5
Bresler, Leonid MS Northwestern University Evanston, IL 60208-0000	Field: Chemical Engineering Laboratory: Armstrong Laboratory AL/EQ Vol-Page No: 7- 1

GSRP Participant Data

Brott, Lawrence BS University of Cincinnati Cincinnati, OH 45221-0012	Field: Materials Science Laboratory: Wright Laboratory WL/ML Vol-Page No: 10- 6
Brown, Kember BS Oregon Graduate Institute of Portland, OR 97291-1000	Field: Electrical Engineering Laboratory: Wright Laboratory WL/EL Vol-Page No: 10- 7
Brown, Kendall MS Univ of Alabama at Huntsville Huntsville, AL 35899-0000	Field: Aeronautics Laboratory: Arnold Engineering Development AEDC/EA Vol-Page No: 11- 1
Callahan, Michael BS Western New England College Springfield, MA 1119-0000	Field: Electrical Engineering Laboratory: Rome Laboratory RL/ER Vol-Page No: 9- 2
Carter, Jamylle MA Univ of Calif, Los Angeles Los Angeles, CA 90024-0000	Field: Mathematics Laboratory: Armstrong Laboratory AL/OE Vol-Page No: 7- 2
Caspar, Richard BS University of Notre Dame Notre Dame, IN 46556-5637	Field: Mechanical Engineering Laboratory: Wright Laboratory WL/MN Vol-Page No: 10- 8
Chen, Shy-Shyan MS New Jersey Inst of Technology Newark, NJ 7102-0000	Field: Computer Science Laboratory: Rome Laboratory RL/IR Vol-Page No: 9- 3
Cifarelli, James BS Clarkson University Potsdam, NY 13699-5722	Field: Electrical Engineering Laboratory: Wright Laboratory WL/PO Vol-Page No: 10- 9
Cravens, Robert MS Ohio University Athens, OH 45701-2979	Field: Electrical Engineering Laboratory: Wright Laboratory WL/PO Vol-Page No: 10-10
Dallam, Thomas MA Virginia Polytech Inst/State U Blacksburg, VA 24060-0436	Field: Psychology Laboratory: Armstrong Laboratory AL/HR Vol-Page No: 7- 3

GSRP Participant Data

Davis, James BS Vanderbilt University Nashville, TN 37235-0000	Field: Electrical Engineering Laboratory: Arnold Engineering Development AEDC/EA Vol-Page No: 11- 2
Dawson, Denisha BA Univ of Calif, Berkeley Berkeley, CA 94720-1460	Field: Chemistry Laboratory: Wright Laboratory WL/PO Vol-Page No: 10-11
De Leon, Irene BS University of Arizona College of Tucson, AZ 85724-0000	Field: Biochemistry Laboratory: Wilfred Hall Medical Center WHMC/WH Vol-Page No: 11-11
DeAngelis, Brian BS Southwest Texas State U San Marcos, TX 78666-0000	Field: Aeronautical Engineering Laboratory: Arnold Engineering Development AEDC/EA Vol-Page No: 11- 3
Dembicki, David BS Tennessee Univ Space Institute Tullahoma, TN 37388-8897	Field: Aerospace Engineering Laboratory: Arnold Engineering Development AEDC/EA Vol-Page No: 11- 4
Ensaf, Peyman BA University of Denver Denver, CO 80208-0177	Field: Physics Laboratory: Phillips Laboratory PL/WS Vol-Page No: 8- 6
Fetterhoff, Eric BS Ohio State University Columbus, OH 43210-0000	Field: Engineering Physics Laboratory: Armstrong Laboratory AL/OE Vol-Page No: 7- 4
Fournier, Lisa PhD Washington State University Pullman, WA 99164-4830	Field: Experimental Psychology Laboratory: Armstrong Laboratory AL/CF Vol-Page No: 7- 5
Friel, Edward MS University of Dayton Dayton, OH 45469-0226	Field: Dept of Electrical Engr Laboratory: Wright Laboratory WL/AA Vol-Page No: 10-12
Garcia, Juan BS Univ of Calif, Los Angeles Los Angeles, CA 90024-0000	Field: Electrical Engineering Laboratory: Phillips Laboratory PL/LI Vol-Page No: 8- 7

GSRP Participant Data

Gonthier, Keith
MS
University of Notre Dame
Notre Dame, IN 46556-5637

Field: Mechanical Engineering
Laboratory: Wright Laboratory
WL/MN
Vol-Page No: 10-13

Grata, Jeremy
BS
Bowling Green State University
Bowling Green, OH 43403-0000

Field: Mathematics
Laboratory: Wright Laboratory
WL/EL
Vol-Page No: 10-14

Greenberg, Marc
MS
Wright State University
Dayton, OH 45435-0000

Field: Toxicology
Laboratory: Armstrong Laboratory
AL/OE
Vol-Page No: 7- 6

Greenis, Jennifer
BS
Michigan State University
East Lansing, MI 48824-0000

Field: Psychology
Laboratory: Armstrong Laboratory
AL/HR
Vol-Page No: 7- 7

Grothaus, Matthew
BA
Medical Coll of Ohio at Toledo
Toledo, 43 43614-0000

Field: Psychology
Laboratory: Armstrong Laboratory
AL/OE
Vol-Page No: 7- 8

Haddock, Jacqueline
MS
Tennessee Univ Space Institute
Tullahoma, TN 37388-8897

Field: Mechanical Engineering
Laboratory: Arnold Engineering Development
AEDC/EA
Vol-Page No: 11- 5

Halket, Richard
BS
Washington State University
Pullman, WA 99164-0000

Field: Geology
Laboratory: Armstrong Laboratory
AL/EQ
Vol-Page No: 7- 9

Healy, Catherine
BS
Univ of Scranton
Scranton, PA 18505-0867

Field: Biology
Laboratory: Armstrong Laboratory
AL/AO
Vol-Page No: 7-10

Hearon, Christopher
MA
Louisiana State University
Baton Rouge, LA 70803-0000

Field: Exercise Physiology
Laboratory: Armstrong Laboratory
AL/CF
Vol-Page No: 7-11

Hiser, Karen
BA
University of Dayton
Dayton, OH 45469-0227

Field: Physics
Laboratory: Wright Laboratory
WL/ML
Vol-Page No: 10-15

GSRP Participant Data

Hong, Winn BS Univ of Calif, Los Angeles Los Angeles, CA 90024-0000	Field: Aerospace Engineering Laboratory: Phillips Laboratory PL/VT Vol-Page No: 8- 8
Hugenroth, Jason BS Louisiana State University Baton Rouge, LA 70803-0000	Field: Mechanical Engineering Laboratory: Wright Laboratory WL/MN Vol-Page No: 10-16
Jones, Michael BS Trinity University San Antonio, TX 78212-0000	Field: Biology Laboratory: Armstrong Laboratory AL/OE Vol-Page No: 7-13
Kaechele, Walter MS Rensselaer Polytechnic Troy, NY 12180-3590	Field: Applied Science Laboratory: Rome Laboratory RL/OC Vol-Page No: 9- 4
Kaul, Ann MS University of New Mexico Albuquerque, NM 87131-0000	Field: Applied Mathematics Laboratory: Phillips Laboratory PL/WS Vol-Page No: 8- 9
Keckler, Andrew MS Syracuse University Syracuse, NY 13244-1150	Field: Electronics Communication Laboratory: Rome Laboratory RL/OC Vol-Page No: 9- 5
Lach, Jan BS Tennessee Univ Space Institute Tullahoma, TN 37388-8897	Field: Mechanical Engineering Laboratory: Arnold Engineering Development AEDC/EA Vol-Page No: 11- 6
Leiweke, Robert MS Ohio State University Columbus, OH 43210-0000	Field: Aerospace Engineering Laboratory: Phillips Laboratory PL/RK Vol-Page No: 8-10
Lindquist, Roger BS University of Dayton Dayton, OH 45469-0227	Field: Electrical Equipment Laboratory: Wright Laboratory WL/AA Vol-Page No: 10-17
Losiewicz, Paul MA Univ of Texas at Austin Austin, TX 78712-0000	Field: Philosophy Laboratory: Wright Laboratory WL/AA Vol-Page No: 10-18

GSRP Participant Data

Lubinsky, Brian
BS
University of Cincinnati
Cincinnati, OH 45221-0030

Field: Electrical Engineering
Laboratory: Rome Laboratory
RL/OC
Vol-Page No: 9- 7

Luetjering, Stephanie
MS
University of Dayton
Dayton, OH 45469-0240

Field: Materials Science
Laboratory: Wright Laboratory
WL/ML
Vol-Page No: 10-19

Mai, John
BS
Univ of Calif, Los Angeles
Los Angeles, CA 90024-0000

Field: Aerospace Engineering
Laboratory: Wright Laboratory
WL/FI
Vol-Page No: 10-20

Maker, David
MA
Oregon Graduate Institute of
Portland, OR 97291-1000

Field: Physics
Laboratory: Phillips Laboratory
PL/LI
Vol-Page No: 8-11

Marsh, Virginia
BS
Univ of Alabama at Tuscaloosa
Tuscaloosa, AL 35487-0278

Field: Mechanical Engineering
Laboratory: Armstrong Laboratory
AL/CF
Vol-Page No: 7-14

Martin III, Roy
BS
Worcester Polytechnic Inst
Worcester, MA 1609-0000

Field: Mechanical Engineering
Laboratory: Phillips Laboratory
PL/SX
Vol-Page No: 8-12

McBrearty, Beth Ann
BS
Univ of Scranton
Scranton, PA 18505-0867

Field: Biology
Laboratory: Armstrong Laboratory
AL/AO
Vol-Page No: 7-15

McGuinness, Michael
BS
SUNY Albany
Albany, NY 12222-0000

Field: Meterology
Laboratory: Phillips Laboratory
PL/WS
Vol-Page No: 8-13

Mehrotra, Vikas
MS
Ohio State University
Columbus, OH 43210-0000

Field: Electrical Engineering
Laboratory: Wright Laboratory
WL/EL
Vol-Page No: 10-21

Meyer, Thomas
BA
St. Mary's Univ of San Antonio
San Antonio, TX 78228-8543

Field: Psychology
Laboratory: Armstrong Laboratory
AL/HR
Vol-Page No: 7-16

GSRP Participant Data

Mickle, Michael
BS
LSU Agri/Mech College
Baton Rouge, LA 70803-0000

Field: Electrical Engineering
Laboratory: Wright Laboratory
WL/MN
Vol-Page No: 10-22

Miller, Michael
BA
Texas A & M Univ-College Station
College Station, TX 77843-4235

Field: Psychology
Laboratory: Armstrong Laboratory
AL/HR
Vol-Page No: 7-17

Mills, Thomas
MS
University of Utah
Salt Lake City, UT 84112-0000

Field: Mechanical Engineering
Laboratory: Wright Laboratory
WL/FI
Vol-Page No: 10-23

Mitchell, Krystin
MS
SUNY Albany
Albany, NY 12222-0000

Field: Industrial & Organizational
Laboratory: Armstrong Laboratory
AL/HR
Vol-Page No: 7-18

Mitts, Chad
BS
Univ of Illinois at Chicago
Chicago, IL 60607-7022

Field: Mechanical Engineering
Laboratory: Phillips Laboratory
PL/RK
Vol-Page No: 8-14

Moore, Michael
MS
Vanderbilt University
Nashville, TN 37235-0000

Field: Electrical Engineering
Laboratory: Arnold Engineering Development
AEDC/EA
Vol-Page No: 11- 7

Morgan, Steven
MS
Virginia Polytech Inst/State U
Blacksburg, VA 24060-0436

Field: Psychology
Laboratory: Armstrong Laboratory
AL/HR
Vol-Page No: 7-19

Moriarty, Daniel
MS
Massachusetts Inst of Technology
Cambridge, MA 2139-0000

Field: Nuclear Engineering
Laboratory: Phillips Laboratory
PL/GP
Vol-Page No: 8-15

Murphy, Suzanne
BS
Massachusetts Inst of Technology
Cambridge, MA 2139-0000

Field: Electrical Engineering
Laboratory: Phillips Laboratory
PL/GP
Vol-Page No: 8-16

Nemeth, Jennifer
MS
Univ of Scranton
Scranton, PA 18510-4626

Field: Chemistry
Laboratory: Armstrong Laboratory
AL/AO
Vol-Page No: 7-20

GSRP Participant Data

Nemeth, Kristie MA Miami University Oxford, OH 45056-0000	Field: Psychology Laboratory: Armstrong Laboratory AL/HR Vol-Page No: 7-21
Nicholson, Jeffrey BS University of New Mexico Albuquerque, NM 87131-0000	Field: Physics Laboratory: Phillips Laboratory PL/LI Vol-Page No: 8-17
Niemeyer, Emily BS SUNY Buffalo Buffalo, NY 14260-3000	Field: Chemistry Laboratory: Wright Laboratory WL/PO Vol-Page No: 10-24
Norman, Samuel BS Southwest Texas State U San Marcos, TX 78666-0000	Field: Chemistry Laboratory: Armstrong Laboratory AL/OE Vol-Page No: 7-22
O'Keefe, Sean BS Cornell University Ithaca, NY 14853-5401	Field: Electrical Engineering Laboratory: Rome Laboratory RL/OC Vol-Page No: 9- 8
Offerdahl, Corey BS North Dakota State University Fargo, ND 58105-0000	Field: Electrical Engineering Laboratory: Armstrong Laboratory AL/AO Vol-Page No: 7-23
Olsen, Bryan BS Brigham Young University Provo, UT 84602-0000	Field: Physics Laboratory: Phillips Laboratory PL/WS Vol-Page No: 8-18
Olsen, Thomas MS Univ of Calif, Davis Davis, CA 95616-0000	Field: Aerospace Engineering Laboratory: Arnold Engineering Development AEDC/EA Vol-Page No: 11- 8
Opalecky, Robert MS University of North Texas Denton, TX 76203-0000	Field: Mathematics Laboratory: Wright Laboratory WL/MN Vol-Page No: 10-25
Oskey, Brian BS Wright State University Dayton, OH 45435-0000	Field: Human Factors Engineering Laboratory: Wright Laboratory WL/AA Vol-Page No: 10-26

GSRP Participant Data

Parlier, Angela BS Auburn University Auburn, AL 36849-5337	Field: Mechanical Engineering Laboratory: Armstrong Laboratory AL/EQ Vol-Page No: 7-24
Perez, Lesley BS Ohio State University Columbus, OH 43210-0000	Field: Civil Engineering Laboratory: Wright Laboratory WL/ML Vol-Page No: 10-27
Piana, Michael MS Cal State Univ, Northridge Northridge, CA 94133-0000	Field: Chemistry Laboratory: Armstrong Laboratory AL/EQ Vol-Page No: 7-25
Popp, Robert MS University of Connecticut Storrs, CT 6269-0000	Field: Computer Science & Eng Laboratory: Rome Laboratory RL/OC Vol-Page No: 9- 9
Preston III, Lon BS Pennsylvania State University University Park, PA 16802-0000	Field: Mechanical Engineering Laboratory: Wright Laboratory WL/PO Vol-Page No: 10-28
Pulaski, Paul MS University of New Mexico Albuquerque, NM 87131-0000	Field: Physics Laboratory: Phillips Laboratory PL/LI Vol-Page No: 8-19
Randolph, Brendon BS Louisiana State University Baton Rouge, LA 70803-5901	Field: Electrical Engineering Laboratory: Wright Laboratory WL/FI Vol-Page No: 10-29
Renzi, Peter BS Boston University Boston, MA 2215-0000	Field: Chemical Engineering Laboratory: Rome Laboratory RL/C3 Vol-Page No: 9-10
Riberdy, Anne MA Boston University Boston, MA 2215-0000	Field: Psychology Laboratory: Armstrong Laboratory AL/CF Vol-Page No: 7-26
Riise, Eric BA Cal State Univ, Chico Chico, CA 95929-0504	Field: Organized Communications Laboratory: Armstrong Laboratory AL/HR Vol-Page No: 7-27

GSRP Participant Data

Ritter, Jason
BS
Clarkson University
Potsdam, NY 13699-5810

Field: Chemistry
Laboratory: Armstrong Laboratory
AL/EQ
Vol-Page No: 7-28

Roessig, Keith
BS
University of Notre Dame
Notre Dame, IN 46556-5637

Field: Aeronautical Engineering
Laboratory: Wright Laboratory
WL/MN
Vol-Page No: 10-30

Rohrbacher, Sharla
BS
Wright State University
Dayton, OH 45435-0000

Field: Electrical Engineering
Laboratory: Wright Laboratory
WL/AA
Vol-Page No: 10-31

Rucker, Dale
BS
West Virginia University
Morgantown, WV 26506-0000

Field: Mechanical Engineering
Laboratory: Armstrong Laboratory
AL/EQ
Vol-Page No: 7-29

Sackett, David
BS
Rochester Inst of Technol
Rochester, NY 14623-0000

Field: Electrical Engineering
Laboratory: Rome Laboratory
RL/OC
Vol-Page No: 9-11

Salasovich, Richard
MS
University of Cincinnati
Cincinnati, OH 45221-0030

Field: Aerospace Engineering
Laboratory: Wright Laboratory
WL/ML
Vol-Page No: 10- 37

Scales, Kevin
BS
University of New Mexico
Albuquerque, NM 87131-0000

Field: Physics
Laboratory: Phillips Laboratory
PL/LI
Vol-Page No: 8-21

Schulte, Michael
MS
University of Cincinnati
Cincinnati, OH 45221-0012

Field: Materials Engineering
Laboratory: Wright Laboratory
WL/ML
Vol-Page No: 10-32

Searcy, Cynthia
MS
University of Georgia
Athens, GA 30602-0000

Field: Psychology
Laboratory: Armstrong Laboratory
AL/HR
Vol-Page No: 7-30

Shah, Pankaj
MS
Wayne State University
Detroit, MI 48202-0000

Field: Electrical Engineering
Laboratory: Wright Laboratory
WL/ML
Vol-Page No: 10-33

GSRP Participant Data

Stanush, Pamela
MS
Texas A & M Univ-College Station
College Station, TX 77843-4235

Field: Psychology
Laboratory: Armstrong Laboratory
AL/HR
Vol-Page No: 7-31

Stellman, Christopher
BS
University of South Carolina
Columbia, SC 29208-0000

Field: Chemistry
Laboratory: Arnold Engineering Development
AEDC/EA
Vol-Page No: 11- 9

Stimson, Mark
MA
University of Georgia
Athens, GA 30602-0000

Field: General Psychology
Laboratory: Armstrong Laboratory
AL/HR
Vol-Page No: 7-32

Stone, John
MS
SUNY Binghamton
Binghamton, NY 13901-0000

Field: Systems Science
Laboratory: Rome Laboratory
RL/IR
Vol-Page No: 9-12

Sturm, James
MS
Oklahoma State University
Stillwater, OK 74078-0000

Field: Electrical Engineering
Laboratory: Rome Laboratory
RL/ER
Vol-Page No: 9-13

Sukow, David
MA
Duke University
Durham, NC 27708-0325

Field: Physics
Laboratory: Phillips Laboratory
PL/LI
Vol-Page No: 8-23

Tehrany, Maria
BS
Trinity University
San Antonio, TX 78212-0000

Field: Biology
Laboratory: Armstrong Laboratory
AL/OE
Vol-Page No: 7-33

Terrill-Stolper, Heidi
MA
New Mexico State University
Las Cruces, NM 88012-0000

Field: Mathematics
Laboratory: Phillips Laboratory
PL/RK
Vol-Page No: 8-24

Thompson, Edward
MS
University of Cincinnati
Cincinnati, OH 45221-0070

Field: Aerosapce Engineering
Laboratory: Wright Laboratory
WL/ML
Vol-Page No: 10-34

Tomlinson, John
BS
Texas Tech University
Lubbock, TX 79409-0000

Field: Physics
Laboratory: Arnold Engineering Development
AEDC/EA
Vol-Page No: 11-10

GSRP Participant Data

Turner, William BS Iowa State University Ames, IA 50011-0000	Field: Mathematics Laboratory: Wright Laboratory WL/FI Vol-Page No: 10-35
Tyner, Renardo BS Auburn University Auburn, AL 36830-0000	Field: Mathematics Laboratory: Armstrong Laboratory AL/CF Vol-Page No: 7-34
Ugweje, Okechukwu MS Florida Atlantic University Boca Raton, FL 33431-0991	Field: Electrical Engineering Laboratory: Rome Laboratory RL/C3 Vol-Page No: 9-14
Wemhoff, Eric BS Univ of Calif, Berkeley Berkeley, CA 94720-0000	Field: Engineering Laboratory: Wright Laboratory WL/MN Vol-Page No: 10-36
White, John BS University of Arizona Tucson, AZ 85721-0000	Field: Physics Laboratory: Phillips Laboratory PL/LI Vol-Page No: 8-25

HSAP Participant Data

Adams, Nicole
1000 School Avenue
Rutherford High School
Springfield, FL 32401-0000

Laboratory: Armstrong Laboratory
AL/EQ
Vol-Page No: 12- 1

Adkins, John
1860 Belvo Rd
Miamisburg High School
Miamisburg, OH 45342-0000

Laboratory: Wright Laboratory
WL/PO
Vol-Page No: 15- 1

Ahrens, Blake
6400 Wyoming NE
Albuquerque Academy
Albuquerque, NM 87109-0000

Laboratory: Phillips Laboratory
PL/WS
Vol-Page No: 13- 1

Alfano, MIchael
100 N. Lakeview Canyon Rd
Westlake High School
Westlake Village, CA 91362-0000

Laboratory: Phillips Laboratory
PL/RK
Vol-Page No: 13- 2

Anderson, Anita
9142 FM 78
Judson High School
Converse, TX 78109-0000

Laboratory: Armstrong Laboratory
AL/HR
Vol-Page No: 12- 2

Bakert, Jonathan
2601 Oneida Street
Sauquoit Valley Senior High
Sauquoit, NY 13456-0000

Laboratory: Rome Laboratory
RL/ER
Vol-Page No: 14- 1

Bala, Arun
4646 Hamilton Wolfe
Northside Health Careers High
San Antonio, TX 78229-0000

Laboratory: Armstrong Laboratory
AL/AO
Vol-Page No: 12- 3

Bellante, Justin
325 Homewood Avenue
Dayton Christian High School
Dayton, OH 45405-0000

Laboratory: Wright Laboratory
WL/PO
Vol-Page No: 15- 2

Blanton, Matthew
5400 Chambersburg Road
Wayne High School
Huber Heights, OH 45424-3798

Laboratory: Wright Laboratory
WL/PO
Vol-Page No: 15- 3

Boyer, Robert
325 Homewood Avenue
Dayton Christian High School
Dayton, OH 45405-4397

Laboratory: Wright Laboratory
WL/FI
Vol-Page No: 15- 4

HSAP Participant Data

Braydich, Laura
1860 Belvo Rd.
Miamisburg High School
Miamisburg, OH 45342-0000

Laboratory: Wright Laboratory
WL/ML
Vol-Page No: 15- 5

Brough, Johnna
1860 Belvo Rd
Miamisburg High School
Miamisburg, OH 45342-0000

Laboratory: Wright Laboratory
WL/ML
Vol-Page No: 15- 6

Brown, Daniel
2601 Oneida Street
Saqoit Valley Central
Sauquoit, NY 13456-0000

Laboratory: Rome Laboratory
RL/C3
Vol-Page No: 14- 2

Cabral, Kim
110 Racetrack Rd
Choctawhatchee High School
Ft Walton, FL 32548-0000

Laboratory: Wright Laboratory
WL/MN
Vol-Page No: 15- 7

Carley, Robyn
400 Hollywood Blvd SW
Ft Walton Beach High
Ft Walton, FL 32548-0000

Laboratory: Wright Laboratory
WL/MN
Vol-Page No: 15- 8

Castellano, Heather
7173 FM 1628
East Central High School
San Antonio, TX 78263-0000

Laboratory: Armstrong Laboratory
AL/AO
Vol-Page No: 12- 4

Cathey, William
800 Niles Road
Port St. Joe High School
Port St. Joe, FL 32456-0000

Laboratory: Armstrong Laboratory
AL/EQ
Vol-Page No: 12- 5

Chadwell, Christopher
5005 Stahl
James Madison High School
San antonio, TX 78247-0000

Laboratory: Armstrong Laboratory
AL/CF
Vol-Page No: 12- 6

Chen, Elaine
390 Lincoln Road
Lincoln-Sudbury Regional High
Sudbury, MA 1776-0000

Laboratory: Rome Laboratory
RL/ER
Vol-Page No: 14- 3

Cheng, Ai-Hsin
400 Eagleland Dr
Brackenridge High School
San Antonio, TX 78210-0000

Laboratory: Armstrong Laboratory
AL/AO
Vol-Page No: 12- 7

HSAP Participant Data

Chockley III, Phillip
401 Eagle Blvd
Shelbyville Central High School
Shelbyville, TN 37160-0000

Laboratory: Arnold Engineering Development
AEDC/EA
Vol-Page No: 16- 1

Ciomperlik, Clayton
7173 FM 1628
East Central High School
San Antonio, TX 78263-9621

Laboratory: Armstrong Laboratory
AL/OE
Vol-Page No: 12- 8

Clark, William
6900 Broadway
Alamo Heights High School
San Antonio, TX 78209-0000

Laboratory: Armstrong Laboratory
AL/HR
Vol-Page No: 12- 9

Copp, Jonathan
500 Walden Street
Concord-Carlisle High School
Concord, MA 1742-0000

Laboratory: Phillips Laboratory
PL/GP
Vol-Page No: 13- 3

Counts, Jennifer
925 Dinah Shore Blvd
Franklin County Senior High
Winchester, TN 37398-0000

Laboratory: Arnold Engineering Development
AEDC/EA
Vol-Page No: 16- 2

Crowe, Allyn
3491 Upper Bellbrook Road
Bellbrook High School
Bellbrook, OH 45305-0000

Laboratory: Wright Laboratory
WL/AA
Vol-Page No: 15- 9

Davis, Laura
1000 School Avenue
Rutherford High School
Springfield, FL 32401-0000

Laboratory: Armstrong Laboratory
AL/EQ
Vol-Page No: 12-11

Decker, James
2601 Oneida Street
Sauquoit Valley Senior High
Sauquoit, NY 13456-0000

Laboratory: Rome Laboratory
RL/C3
Vol-Page No: 14- 4

Deibler, Nancy
110 Racetrack Rd NW
Choctawhatchee High School
Ft. Walton Beach, FL 32547-0000

Laboratory: Wright Laboratory
WL/MN
Vol-Page No: 15-10

Dennis, Cindi
2660 Dayton-Xenia Road
Beavercreek High School
Dayton, OH 45385-0000

Laboratory: Wright Laboratory
WL/FI
Vol-Page No: 15-11

HSAP Participant Data

Dooley, Michael 800 E. John Sims Parkway Niceville Senior High School Niceville, FL 32578-0000	Laboratory: Wright Laboratory WL/MN Vol-Page No: 15-12
Duff, Alexander 7801 Wilshire Blvd NE LaCueva High School Albuquerque, NM 87122-0000	Laboratory: Phillips Laboratory PL/VT Vol-Page No: 13- 4
Dylla, Rebecca 7173 FM 1628 East Central High School San Antonio, TX 78263-9621	Laboratory: Armstrong Laboratory AL/OE Vol-Page No: 12-13
Fann, Michael 1001 North Jackson Street Tullahoma High School Tullahoma, TN 37388-4357	Laboratory: Arnold Engineering Development AEDC/EA Vol-Page No: 16- 3
Fecke, Mark 505 South Ludlow Street Chaminade-Julienne High School Dayton, OH 45402-0000	Laboratory: Wright Laboratory WL/PO Vol-Page No: 15-13
Fitzgerald, Mary 8079 Thompson Rd Holland Patent High School Holland Patent, NY 13354-0000	Laboratory: Rome Laboratory RL/IR Vol-Page No: 14- 5
Fleisher, Daniel 360 Lowell Avenue Newton North High School Newtonville, MA 2161-0000	Laboratory: Phillips Laboratory PL/GP Vol-Page No: 13- 5
Flores, Nicholas 521 S. New Braunfels Ave St. Gerard Catholic High School San Antonio, TX 78203-0000	Laboratory: Armstrong Laboratory AL/OE Vol-Page No: 12-14
Fordham, Zackary 1000 School Avenue Rutherford High School Springfield, FL 32401-0000	Laboratory: Wright Laboratory WL/FI Vol-Page No: 15-14
Fortner, Craig 300 West Granville Rd Thomas Worthington High School Worthington, OH 43085-0000	Laboratory: Wright Laboratory WL/ML Vol-Page No: 15-15

HSAP Participant Data

Fouts, Laura
325 Homewood Avenue
Dayton Christian High School
Dayton, OH 45405-0000

Laboratory: Wright Laboratory
WL/EL
Vol-Page No: 15-16

Garcia, Alfredo
4524 Linden Avenue
Carroll High School
Dayton, OH 45432-0000

Laboratory: Wright Laboratory
WL/ML
Vol-Page No: 15-17

Garcia, Christopher
607 S.W. 34th Street
Edgewood ISD
San Antonio, TX 78237-0000

Laboratory: Armstrong Laboratory
AL/HR
Vol-Page No: 12-15

Geeting, Derek
401 Eagle Blvd
Shelbyville Central High School
Shelbyville, TN 37160-0000

Laboratory: Arnold Engineering Development
AEDC/EA
Vol-Page No: 16- 4

Giles, Paul
5005 Stahl Road
James Madison High School
San Antonio, TX 78247-0000

Laboratory: Armstrong Laboratory
AL/AO
Vol-Page No: 12-16

Glaser, Robert
4524 Linden Ave
Carroll High School
Dayton, OH 45432-0000

Laboratory: Wright Laboratory
WL/PO
Vol-Page No: 15-18

Goel, Ajay
500 E. Franklin Street
Centerville High School
Centerville, OH 45459-0000

Laboratory: Wright Laboratory
WL/FI
Vol-Page No: 15-19

Govenar, Stephen
2660 Dayton-Xenia Road
Beavercreek High School
Dayton, OH 45434-0000

Laboratory: Wright Laboratory
WL/EL
Vol-Page No: 15-20

Griffy, Neil
106 Hill Street
Brookville High School
Brookville, OH 45309-0000

Laboratory: Wright Laboratory
WL/PO
Vol-Page No: 15-21

Gudorf, Matthew
4524 Linden Avenue
Carroll High School
Dayton, OH 45432-0000

Laboratory: Wright Laboratory
WL/ML
Vol-Page No: 15-22

HSAP Participant Data

Guerrero, Cynthia
3118 Elgin Ave
Highlands High School
San Antonio, TX 78210-0000

Laboratory: Armstrong Laboratory
AL/CF
Vol-Page No: 12-17

Guillermin, Shaun
505 South Ludlow Street
Chaminade-Julienne High School
Dayton, OH 45402-0000

Laboratory: Wright Laboratory
WL/PO
Vol-Page No: 15-23

Gurecki, David
800 Cypress Street
Rome Catholic High School
Rome, NY 13440-0000

Laboratory: Rome Laboratory
RL/C3
Vol-Page No: 14- 6

Harmon, Kelly
501 Mosley Drive
A. Crawford Mosely High School
Lynn Haven, FL 32444-0000

Laboratory: Armstrong Laboratory
AL/EQ
Vol-Page No: 12-18

Hayduk, Eric
800 Cypress Street
Rome Catholic High School
Rome, NY 13440-0000

Laboratory: Rome Laboratory
RL/OC
Vol-Page No: 14- 7

Hernandez, David
Kylea Laird Dr
Freeport High School
Freeport, FL 32439-0000

Laboratory: Wright Laboratory
WL/MN
Vol-Page No: 15-24

Hunderman, Kyle
11300 Montgomery Boulevard NE
Eldorado High School
Albuquerque, NM 87112-0000

Laboratory: Phillips Laboratory
PL/VT
Vol-Page No: 13- 6

Hurst, Venessa
Rte 8, Bx 590
Walton High School
DeFuniak, FL 32433-0000

Laboratory: Wright Laboratory
WL/MN
Vol-Page No: 15-25

Hutchens, Brian
2660 Dayton-Xenia Road
Beavercreek High School
Dayton, OH 45434-0000

Laboratory: Armstrong Laboratory
AL/OE
Vol-Page No: 12-19

Iliev, Karl
44900 North Division St
Antelope Valley High School
Lancaster, CA 93535-0000

Laboratory: Phillips Laboratory
PL/RK
Vol-Page No: 13- 7

HSAP Participant Data

Johnson, Jennifer
4524 Linden Avenue
Carroll High School
Dayton, OH 45432-0000

Laboratory: Wright Laboratory
WL/ML
Vol-Page No: 15-26

Johnson, Karen
5005 Stahl Rd
James Madison High School
San Antonio, TX 78247-0000

Laboratory: Armstrong Laboratory
AL/AO
Vol-Page No: 12-20

Johnson, Sharleen
33 Oxford Road
New Hartford Senior High School
New Hartford, NY 13413-0000

Laboratory: Rome Laboratory
RL/ER
Vol-Page No: 14- 8

Kaczorek, Andrew
1001 North Jackson Street
Tullahoma High School
Tullahoma, TN 37388-4357

Laboratory: Arnold Engineering Development
AEDC/EA
Vol-Page No: 16- 5

Kalmus, Rebecca
532 Osuna Rd NE
Sandia Preparatory School
Albuquerque, NM 87113-0000

Laboratory: Phillips Laboratory
PL/LI
Vol-Page No: 13- 8

Kemper, Damian
12049 Blanco Rd.
Winston Churchill High School
San Antonio, TX 78216-0000

Laboratory: Armstrong Laboratory
AL/AO
Vol-Page No: 12-21

Landry, David
925 Dinah Shore Blvd
Franklin County Senior High
Winchester, TN 37398-0000

Laboratory: Arnold Engineering Development
AEDC/EA
Vol-Page No: 16- 6

Le, Hong Van
200 Richardson Road
Chelmsford High School
North Chelmsford, MA 1863-0000

Laboratory: Phillips Laboratory
PL/GP
Vol-Page No: 13- 9

Leopold, Jason
3491 Upper Bellbrook Road
Bellbrook High School
Bellbrook, OH 45305-0000

Laboratory: Wright Laboratory
WL/AA
Vol-Page No: 15-28

Lopez, Adriana
7173 FM 1628
East Central High School
San Antonio, TX 78263-9621

Laboratory: Armstrong Laboratory
AL/OE
Vol-Page No: 12-22

HSAP Participant Data

Manno, Michael
Palmer Street
Frankfort-Schuyler Central School
Frankfort, NY 13340-0000

Laboratory: Rome Laboratory
RL/ER
Vol-Page No: 14- 9

Mattingley, Steve
501 Mosley Dr
Mosley High School
Lynn Haven, FL 32444-0000

Laboratory: Armstrong Laboratory
WL/FI
Vol-Page No: 15-23

McAlpine, Scott
500 East Franklin St
Centerville High School
Centerville, OH 45459-5799

Laboratory: Wright Laboratory
WL/PO
Vol-Page No: 15-29

McEuen, Eric
800 Odelia Road NE
Albuquerque High School
Albuquerque, NM 87102-0000

Laboratory: Phillips Laboratory
PL/LI
Vol-Page No: 13-10

McKinley, Elizabeth
9830 West National Road
Techumseh High School
New Carlisle, OH 45344-0000

Laboratory: Armstrong Laboratory
AL/HR
Vol-Page No: 12-24

McMahan, Eric
2001 McArthur Street
Coffee County Central High School
Manchester, TN 37355-0000

Laboratory: Arnold Engineering Development
AEDC/EA
Vol-Page No: 16- 7

McPherson, Sandra
Jefferson & Grove St.
Bishop Brossart High School
Alexandria, KY 41001-0000

Laboratory: Wright Laboratory
WL/ML
Vol-Page No: 15-30

Michelback, Jerome
4700 Coal Avenue SE
Highland High School
Albuquerque, NM 87108-0000

Laboratory: Phillips Laboratory
PL/WS
Vol-Page No: 13-11

Miller, Angela
5400 Chambersburg Road
Wayne High School
Huber Heights, OH 45424-0000

Laboratory: Wright Laboratory
WL/AA
Vol-Page No: 15-31

Miller, Fawn
12200 Lomas Boulevard NE
Manzano High School
Albuquerque, NM 87112-0000

Laboratory: Phillips Laboratory
PL/VT
Vol-Page No: 13-12

HSAP Participant Data

Murphy, Shannon
119 East Craig
Keystone School
San Antonio, TX 78212-0000

Laboratory: Armstrong Laboratory
AL/CF

Vol-Page No: 12-26

Nataraj, Raviraj
2660 Dayton-Xenia Road
Beavercreek High School
Dayton, OH 45434-0000

Laboratory: Wright Laboratory
WL/FI

Vol-Page No: 15-32

Nee, Ann
500 East Franklin St
Centerville High School
Centerville, OH 45459-5799

Laboratory: Wright Laboratory
WL/ML

Vol-Page No: 15-33

Nesky, Mark
390 Lincoln Road
Lincoln-Sudbury Regional High
Sudbury, MA 1776-0000

Laboratory: Phillips Laboratory
PL/GP

Vol-Page No: 13-13

Niemeyer, Julie
1505 Candelara Rd NW
Valley High School
Albuquerque, NM 87107-0000

Laboratory: Phillips Laboratory
PL/VT

Vol-Page No: 13-14

Nyholt, Jamie
6040 West Avenue L
Quartz Hill High School
Quartz Hill, CA 93536-0000

Laboratory: Phillips Laboratory
PL/RK

Vol-Page No: 13-15

Orchard, Lewis
532 Osuna Road NE
Sandia Preparatory School
Albuquerque, NM 87113-0000

Laboratory: Phillips Laboratory
PL/LI

Vol-Page No: 13-16

Palmquist, Brooke
26831 Prospect
Boron High School
Boron, CA 93516-0000

Laboratory: Phillips Laboratory
PL/RK

Vol-Page No: 13-17

Patterson, Jennifer
8000 Lobo Lane
John Marshall High School
San Antonio, TX 78240-0000

Laboratory: Armstrong Laboratory
AL/HR

Vol-Page No: 12-27

Paz, Crystal
2515 Navajo Street
South San Antonio High School
San Antonio, TX 78224-0000

Laboratory: Armstrong Laboratory
AL/OE

Vol-Page No: 12-28

HSAP Participant Data

Pepin, David
3950 South Tecumseh Road
Greenon High School
Springfield, OH 45502-0000

Laboratory: Wright Laboratory
WL/FI
Vol-Page No: 15-34

Perry, Neill
1304 N. Ferdon Blvd
Crestview High School
Crestview, FL 32536-0000

Laboratory: Wright Laboratory
WL/MN
Vol-Page No: 15-35

Pickney, Laura
925 Dinah Shore Blvd
Franklin County Senior High
Winchester, TN 37398-0000

Laboratory: Arnold Engineering Development
AEDC/EA
Vol-Page No: 16- 8

Power, Shaun
325 Ledbetter Rd, PO Bx 640
Heritage Christian School
Xenia, OH 45385-0000

Laboratory: Wright Laboratory
WL/AA
Vol-Page No: 15-36

Rabe, Angela
4524 Linden Avenue
Carroll High School
Dayton, OH 45432-0000

Laboratory: Wright Laboratory
WL/PO
Vol-Page No: 15-37

Reyher III, Franklin
800 E. John Sims Parkway
Niceville Senior High School
Niceville, FL 32578-0000

Laboratory: Wright Laboratory
WL/MN
Vol-Page No: 15-38

Ritchie, Douglas
800 E. John Sims Parkway
Niceville Senior High School
Niceville, FL 32578-0000

Laboratory: Wright Laboratory
WL/MN
Vol-Page No: 15-39

Rosenberg, David
1400 Jackson-Keller
Robert E. Lee High School
San Antonio, TX 78213-0000

Laboratory: Armstrong Laboratory
AL/AO
Vol-Page No: 12-30

Ross, Timothy
3950 South Tecumseh Road
Greenon High School
Springfield, OH 45502-0000

Laboratory: Armstrong Laboratory
AL/CF
Vol-Page No: 12-31

Sargent, Pete
5400 Chambersburg Road
Wayne High School
Huber Heights, OH 45424-0000

Laboratory: Wright Laboratory
WL/ML
Vol-Page No: 15-41

HSAP Participant Data

Scheel, Rebecca
5005 Stahl Rd
James Madison High School
San Antonio, TX 78247-0000

Laboratory: Armstrong Laboratory
AL/AO
Vol-Page No: 12-32

Scheiderich, Kathleen
800 Cypress Street
Rome Catholic High School
Rome, NY 13440-0000

Laboratory: Rome Laboratory
RL/IR
Vol-Page No: 14-10

Schlieper, Kevin
555 North Hyatt St
Tippecanoe High School
Tipp City, OH 45371-0000

Laboratory: Wright Laboratory
WL/AA
Vol-Page No: 15-42

Schoenfeld, Michael
101 West College Blvd
New Mexico Military Institute
Roswell, NM 88201-5173

Laboratory: Phillips Laboratory
PL/VT
Vol-Page No: 13-18

Schuyler, Seth
532 Osuna Road NE
Sandia Preparatory School
Albuquerque, NM 87113-0000

Laboratory: Phillips Laboratory
PL/VT
Vol-Page No: 13-19

Schwartz, Heidi
Oswego Street
Camden High School
Camden, NY 13316-0000

Laboratory: Rome Laboratory
RL/OC
Vol-Page No: 14-11

Selman, Jesse
925 Dinah Shore Blvd
Franklin County Senior High
Winchester, TN 37398-0000

Laboratory: Arnold Engineering Development
AEDC/EA
Vol-Page No: 16- 9

Shaw, Keith
2923 Bitters Road
MacArthur High School
San Antonio, TX 78217-0000

Laboratory: Armstrong Laboratory
AL/CF
Vol-Page No: 12-33

Sheffield, Ryan
800 E. John Sims Parkway
Niceville Senior High School
Niceville, FL 32578-0000

Laboratory: Wright Laboratory
WL/MN
Vol-Page No: 15-43

Sieja, Damian
7801 Candelaria NE
Sandia High School
Albuquerque, NM 87110-0000

Laboratory: Phillips Laboratory
PL/WS
Vol-Page No: 13-20

HSAP Participant Data

Simon, Ryan
2660 Dayton-Xenia Road
Beavercreek High School
Dayton, OH 45434-0000

Laboratory: Armstrong Laboratory
AL/OE
Vol-Page No: 12-34

Skebo, Robert
2660 Dayton-Xenia Road
Beavercreek High School
Dayton, OH 45385-0000

Laboratory: Wright Laboratory
WL/ML
Vol-Page No: 15-44

Smith, Rebecca
3301 Shroyer Road
Kettering Fairmont High School
Kettering, OH 45429-0000

Laboratory: Wright Laboratory
WL/PO
Vol-Page No: 15-45

Spears, Brian
7173 FM 1628
East Central High School
San Antonio, TX 78263-9621

Laboratory: Armstrong Laboratory
AL/HR
Vol-Page No: 12-35

Stafford, Laura
500 East Franklin
Centerville High School
Centerville, OH 45459-0000

Laboratory: Armstrong Laboratory
AL/CF
Vol-Page No: 12-36

Steffano, Nicholas
3301 Shroyer Road
Kettering Fairmont High School
Kettering, OH 45429-0000

Laboratory: Wright Laboratory
WL/FI
Vol-Page No: 15-46

Stevenson, Ross
2001 McArthur Street
Coffee County Central High School
Manchester, TN 37355-0000

Laboratory: Arnold Engineering Development
AEDC/EA
Vol-Page No: 16-10

Stockert, Todd
500 East Franklin Street
Centerville High School
Centerville, OH 45459-0000

Laboratory: Wright Laboratory
WL/EL
Vol-Page No: 15-47

Stout, Patrick
Oswego Street
Camden High School
Camden, NY 13316-0000

Laboratory: Rome Laboratory
RL/IR
Vol-Page No: 14-12

Strong, Melanie
4524 Linden Avenue
Carroll High School
Dayton, OH 45432-0000

Laboratory: Armstrong Laboratory
AL/CF
Vol-Page No: 12-37

Theodore, Lauren 390 Lincoln Road Lincoln-Sudbury Regional High Sudbury, MA 1776-0000	Laboratory: Rome Laboratory RL/ER Vol-Page No: 14-13
Thompson, Emily 3301 Shroyer Road Kettering Fairmont High School Kettering, OH 45429-0000	Laboratory: Armstrong Laboratory AL/CF Vol-Page No: 12-38
Thompson, Jeroen 2660 Dayton-Xenia Road Beavercreek High School Dayton, OH 45434-0000	Laboratory: Wright Laboratory WL/ML Vol-Page No: 15-48
Thompson, Richard 1900 Harshman Road Walter E. Stebbins High School Dayton, OH 45424-0000	Laboratory: Wright Laboratory WL/EL Vol-Page No: 15-49
Tu, Albert 800 E. John Sims Parkway Niceville Senior High School Niceville, FL 32578-0000	Laboratory: Wright Laboratory WL/MN Vol-Page No: 15-50
Vest, John 800 E. John Sims Parkway Niceville Senior High School Niceville, FL 32578-0000	Laboratory: Wright Laboratory WL/MN Vol-Page No: 15-51
Villalpando, Matthew 3118 Elgin Ave Highlands High School San Antonio, TX 78210-0000	Laboratory: Armstrong Laboratory AL/OE Vol-Page No: 12-40
Vinarskai, Jonathan 2220 N.W. Military Hwy Castle Hills First Baptist School San Antonio, TX 78213-0000	Laboratory: Armstrong Laboratory AL/CF Vol-Page No: 12-41
Walker, Elizabeth 800 E. John Sims Parkway Niceville Senior High School Niceville, FL 32578-0000	Laboratory: Wright Laboratory WL/MN Vol-Page No: 15-52
Weaver, Joshua 800 E. John Sims Parkway Niceville Senior High School Niceville, FL 32578-0000	Laboratory: Wright Laboratory WL/MN Vol-Page No: 15-53

HSAP Participant Data

Whalen, Thomas
4524 Linden Ave
Carroll High School
Dayton, OH 45432-0000

Laboratory: Wright Laboratory
WL/AA
Vol-Page No: 15-54

WhiteWolf, Gabrielle
110 Racetrack Rd
Choctawhatchee High School
Ft Walton, FL 32548-0000

Laboratory: Wright Laboratory
WL/MN
Vol-Page No: 15-55

Wilson, Michael
1000 School Avenue
Rutherford High School
Springfield, FL 32401-0000

Laboratory: Armstrong Laboratory
AL/EQ
Vol-Page No: 12-42

Wisdahl, Michele
800 Niles Road
Port St. Joe High School
Port Saint Joe, FL 32456-2299

Laboratory: Armstrong Laboratory
AL/EQ
Vol-Page No: 12-43

Yang, Tuan
110 Racetrack Rd
Choctawhatchee High School
Ft Walton, FL 32548-0000

Laboratory: Wright Laboratory
WL/MN
Vol-Page No: 15-56

Yu, Eric
900 E. Dayton-Yellow Sprgs Rd
Fairborn High School
Fairborn, OH 45324-0000

Laboratory: Armstrong Laboratory
AL/CF
Vol-Page No: 12-44

Zigmond, Stephanie
7173 Farm Road 1628
East Central High School
San Antonio, TX 78263-0000

Laboratory: Armstrong Laboratory
AL/CF
Vol-Page No: 12-45

ATM DS-3 EXPERIMENTS VIA THE ADVANCED COMMUNICATION TECHNOLOGY SATELLITE

Valentine Aalo
Electrical Engineering Department
Florida Atlantic University

Okechukwu Ugweje
Electrical Engineering Department
Florida Atlantic University

Mostafa Chinichian
Electrical Engineering Department
California Polytechnic State University

Abstract

A series of experiments were conducted via the ACTS DS-3 link carrying ATM traffic in a PLCP frame format. These experiments were performed between Rome Laboratory, Griffiss Air Force Base, New York and Communication Research Centre, Nepean, Canada. These tests were conducted to test the viability of ATM DS-3 bearers via the satellite at a performance level comparable to that of terrestrial fiber optic link or microwave link. In these tests, both single and multiple channels configurations of ATM satellite bearers were tested. The single channel experiments were configure to fully load the channel at 96,000 Cells per second, while the multiple channel experiments were used to assess the ability of ATM protocol to carry information from different sources at different rates. Our main objective of characterizing the DS-3 satellite channel for the transmission of ATM signals was achieved, and the result obtained were presented and analyzed.

PERFORMANCE ANALYSIS OF HIGH THROUGHPUT OPTICAL COMMUNICATION NETWORKS

Behnaam Aazhang
Professor
Department of Electrical and Computer Engineering
Rice University
Houston, Texas 77251-1892

Abstract

Practical, very high speed networks are critical to support the next generation of information technology applications, such as high-performance computing environments, access to vast electronic libraries, and multimedia communication of voice, data, graphics, and video for business, medical, and industrial needs. In this research program, we designed and demonstrated a novel multiuser optical communication network based on bipolar data encoding and decoding technology. The research work under Air Force Summer Faculty program concentrate on performance analysis of the proposed system. This novel multiuser system successfully meets the challenge of using the enormous bandwidths of optical channels by placing the burden of handling high bit rates on simple optics, rather than on ultrafast electronics or complex laser sources, making practical and economical implementation a real near-term possibility.

ANALYSIS OF TURBULENT, SUPERSONIC, AND AXISYMMETRIC PLUME DATA

Saad A. Ahmed
Associate Professor
Mechanical Engineering Department
KFUPM, Dhahran 31261, KSA

ABSTRACT

Analysis of experimental data obtained in the flowfield of a generic tactical missile configuration in simulated powered flight is performed. Mean velocities, Reynolds stresses, triple products, and higher order statistics measured by a two component LDV system working, in the off-axis forward scatter mode, were analyzed. A balance of the turbulence energy equation have been performed in order to get a more detailed insight into the turbulent behavior. The analysis utilized the experimental LDV data to determine the turbulence production, diffusion, convection and viscous dissipation. The analysis of the data was successful in identifying the various areas of interest in the flowfield where different turbulent transport mechanisms dominate.

SYSTEMATIC BIAS OF MEMORY FOR LOCATIONS IN TWO-DIMENSIONAL ARRAYS

Gary L. Allen
Associate Professor
Department of Psychology
University of South Carolina

Abstract

Previous research indicated that memory for locations in two-dimensional graphic arrays is encoded as polar coordinates and is systematically biased such that locations are remembered toward the middle of quadrants that observers impose implicitly on the array. The results of the present experiment replicate these findings and further point to encoding time as a factor influencing the radial distance portion of this bias. These findings suggest the value of future experiments aimed at determining how other salient variables (such as a differentiated array space or multiple potential targets) impacts bias of this type.

REDUCTIVE DEGRADATION AND SORPTION OF *cis*- AND *trans*-1,2-DICHLOROETHENE IN A METALLIC IRON/WATER SYSTEM

Richelle M. Allen-King, Assistant Professor and
Richard M. Halket, Graduate Student
Department of Geology
Washington State University
Pullman, WA 99164-2812

ABSTRACT

Reductive transformation kinetic and sorption coefficients were determined for both *cis*- and *trans*-1,2-dichloroethene (DCE) in batch systems with zero-valent iron and water. Chloride was produced by the transformation reaction and chlorine mass balances for the batch systems were 80 to 85%. The transformation reaction was not first order in solution concentration or total system concentration for either of the two isomers. Measured reaction rate coefficients (λ_a) and orders (N_a) for the two compounds in experiments with initial concentrations of approximately 1850 nmol/ml were: 0.17 [nmol/hr]/[(nmol/ml)^{N_a}] (ln λ_a = -1.79) and 0.00023 [nmol/hr]/[(nmol/ml)^{N_a}] (ln λ_a = -8.37) with reaction orders 1.22 and 1.77 for *trans*-1,2-DCE and *cis*-1,2-DCE, respectively. Sorption equilibrium was apparently attained within 1.1 hr. The form of sorption could be adequately described by Freundlich-type isotherms for both compounds over the concentration range measured. The magnitude of sorption was greater for *trans*-1,2-DCE than for the more soluble *cis*-1,2-DCE. The distribution of organic products produced by the two isomers indicates some divergence in reaction pathways. While both compounds produced large proportions of ethene and ethane, transformation of *cis-1,2*-DCE resulted in significantly greater production of vinyl chloride than did *trans*-1,2-DCE.

RAT PUP ULTRASONIC VOCALIZATIONS: TERATOLOGIC EFFECTS OF EXPOSURE TO ULTRA-WIDE BAND ELECTROMAGNETIC RADIATION

Suzanne C. Baker
Assistant Professor
Department of Psychology
James Madison University

Abstract

Neonatal rats (Rattus norvegicus) typically emit ultrasonic vocalizations (UVs) when removed from their home cages and isolated from their mother and littermates. These isolation-induced UVs have been shown to be sensitive to the effects of various neuroactive substances. These vocalizations have been utilized by researchers as behavioral indicators of stress or emotionality, and they provide a useful animal model of anxiety for the investigation of the effects of various anxiogenic and anxiolytic drugs, and for teratogenic effects. This paper presents preliminary results of a study designed to examine the effects of prenatal exposure to ultra-wide band (UWB) electromagnetic radiation on rat pup isolation-induced UVs. Three groups of rat pups (prenatally exposed to lead; prenatally exposed to UWB radiation; and control) were tested for UV emission in an isolation paradigm. It was expected that the lead group would show effect of the prenatal exposure, and that (consistent with earlier studies showing no effects of UWB exposures on adults) the UWB and control groups would not exhibit significant differences in UV parameters. Findings in general were consistent with these hypotheses.

THE EFFECT OF CORROSION ON FATIGUE CRACK GROWTH RATES IN AIRCRAFT STRUCTURAL ALUMINUM ALLOYS

J. David Baldwin
Assistant Professor
School of Aerospace and Mechanical Engineering
The University of Oklahoma

Abstract

One of the goals of the C/KC-135 Corrosion Fatigue program is to quantify the effect prior corrosion damage has on the fatigue strength of aluminum structural alloys. To support this goal, fatigue crack growth rates were recorded for artificially-corroded specimens of aluminum alloys 2024-T3, 2024-T4 and 7075-T6. The artificial corrosion was previously classified by Boeing as "severe." Corrosion reduced test specimen thickness approximately 3-5% as verified with spot measurements using a pointed tip micrometer. For a given alloy, specimens were tested in two environments (< 15% RH air and > 85% RH air) and at two stress ratios (R = 0.05 and R = 0.50). Two specimens per environment/stress ratio pair were tested, for a total of eight specimens per material. All of the tests were run at a constant amplitude cyclic load frequency of 10 Hertz.

Very rough estimates of noncorroded material crack growth behavior were made for comparison with the results from the corroded material. The general trend found was that the corroded material experienced higher crack growth rates than the noncorroded material. As expected, it was also observed that the more aggressive environment (> 85% RH air) and the higher stress ratio (R = 0.50) accelerated crack growth rates in the artificially-corroded materials.

MODEL-BASED SYSTEM DEVELOPMENT FOR AEROSPACE TESTING INSTRUMENTATION

Theodore A. Bapty
Research Assistant Professor

James R. Davis
Graduate Student
Department of Electrical and Computer Engineering

Abstract

The complexity of modern aerospace systems requires significant amounts of testing to ensure correct operation and cost effective development. Ground testing enables extremely accurate control over the external conditions along with the ability to acquire a large number of measurements of internal engine structures.

Analysis and verification of turbine engine testing data is a computationally intensive, dynamic process. The combination of high bandwidths, large numbers of channels, and constantly changing processing requirements place many demands on an instrumentation and data analysis system. The complexity of building and managing the data systems necessary for the analysis/verification requirement is a difficult task, considering the real-time, parallel, and reactive characteristics of these systems.

Several systems have been developed at AEDC using **Model-Based** system synthesis techniques. This report describes three systems in various stages of development. The Computer Assisted Dynamic Data Acquisition and Monitoring System(CADDMAS), developed in conjunction with Arnold Engineering Development Center, has been in operation for two years in support of simulated altitude turbine engine stress testing. The system uses parallel processing to sustain over 800 million floating point operations per second(MFLOPS) producing on-line data analysis plots, delivering true supercomputer performance. Various improvements to the system have been implemented during the program.

Invention and Evaluation of the
Barrel-Launched Adaptive Munition (BLAM)

Ron Barrett
Assistant Professor Aerospace Engineering Department
Auburn University, Al 36849

ABSTRACT

The basic properties of a newly invented class of hybrid munitions are presented. These Barrel-Launched Adaptive Munitions (BLAM) blend the characteristics of missiles and ammunition to form a new type of guided bullet or cannon shell. The chosen design is a 10° half-angle cone which is split in two with a forward spike and a truncated conical aft skirt. The two pieces are pivoted around a central ball-joint and held together by piezoelectric adaptive tendons. This allows the front portion of the cone to rotate in any direction up to ±1° with respect to the rear portion of the cone.

The first part of the study was experimental and involved the fabrication and testing of an active bench-test article and models for range firing. The adaptive tendons were fabricated using newly developed manufacturing techniques which lead to shock-resistant actuators capable of enduring hard launch loads. The prototype tendons were 0.15" (3.81mm) wide and were constructed from a pair of 2.5" (63.5mm) long 7.5 mil (190.5 μm) thick PZT-5H piezoceramic sheets which were sandwiched on either side of 4" (101.6mm) long, 5 mil (127 μm) thick aluminum foil. Test results show that at 68°F (20°C), the adaptive members were precompressed to record levels of 947μstrain (57.8 MPa or 8.37 ksi) while the aluminum substrate was pre-tensioned to 2473μstrain (173 MPa or 25.1 ksi). The low substrate-actuator strength ratio (Ψ = 0.381) lead to a 72% maintenance of active strain levels between the free-PZT sheet and combined element performance. Modified laminated plate theory was used to demonstrate that the extremely high pre-compression level was sufficient for withstanding launch loads up to 20,000 g's. At maximum ±400 μstrain levels, the elements could generate articulation angles up to ±0.28°. The BLAM bench prototype was determined to have a first natural frequency of 228 Hz (1,433 rad/s) with a full-cycle response time under 5ms.

The second section of research compares the overall performance of conventional ammunition to the projected performance of the BLAMs. Because BLAMs would be insensitive to gravity and most cross-winds (above minimum flight speeds), their effective ranges are substantially increased. A basic performance code compared the 20mm PGU-28 to an identically shaped BLAM. Considering a minimum impact velocity of 700 ft/s (213 m/s), the effective ranges were more than doubled to 2 mi (3.2km). Projections also demonstrated the potential of a 105mm BLAM fired at 2,000 ft/s (610 m/s). Domes of strike opportunity were calculated and showed that air targets traveling around Mach 1, at 10,000 ft (3.05 km) altitude could be engaged at ranges exceeding 4 mi (6.4 km). Under the same conditions, ground targets within a 7 mi (11.3 km) radius footprint could be hit. A final section examining the high altitude performance BLAMs demonstrated that from 50,000 ft (15.2 km) launch altitude, hypervelocity rounds could be used effectively against ground targets within a 30 mi (48.3 km) diameter footprint as well as satellites and ballistic missiles up to 100 mi. (161 km) in altitude.

A GENERAL METHODOLOGY FOR CLUSTERING AND SEQUENCING ALGORITHMS WITH APPLICATIONS TO INTELLIGENT KNOWLEDGE-BASED MANUFACTURING/MACHINING SYSTEMS

Georges A. Bécus and Edward A. Thompson

ABSTRACT

Product design and process planning have been separate activities. Even with the advent of computer aided design, CAD systems have been extensively used in the automation of product design, while process design or planning has remained a separate and primarily manual effort with little or no automation. Although there have been numerous efforts (e.g. group technology involving variant and generative techniques) and research in the area of product design and process planning integration, most research has addressed only a portion of the problem, i.e., either the product design or process planning. The integration of shape, function, material and process design is a goal which offers many challenges to overcome. After reviewing Adaptive Modeling Language (AML), an approach and implementation for integrating product and process design in a virtual manufacturing environment involving competing processes, this report presents a general methodology and general purpose algorithms for clustering and sequencing under (precedence) constraints. These algorithms could easily be integrated in AML or other Intelligent Knowledge-Based-Engineering systems to perform such tasks as setup generation/sequencing and feature/operation sequencing. The algorithms employ an Annealing Genetic strategy together with special purpose operators and repair functions as the optimization engine. Our approach, flexible enough to allow user interaction, finds very quickly (near) optimal solutions of higher quality than existing methods.

KEYWORDS: Intelligent Knowledge-Based Engineering, Adaptive Modeling Language, Process Planning, Operation-Based Design, Machining, Clustering, Sequencing, Annealing Genetic Algorithm.

INTRODUCTION

Today enterprises have to compete in an ever changing global market environment which requires fast appropriate decisions. Process costs and product affordability, which form the basis for competing in the marketplace, are often adversely affected by customer demands dictating quick response and imposing continual changes to the product development cycle therby lengthening development time. Investigating new materials and processes to lower costs while enhancing product performance is a goal pursued by every manufacturer.

DEVELOPMENT OF A TIME-DOMAIN ELECTROMAGNETICS SIMULATION ENVIRONMENT

John H. Beggs
Assistant Professor
Department of Electrical and Computer Engineering
Mississippi State University

Abstract

A time-domain computational electromagnetics simulation environment was developed. This environment includes a time-domain electromagnetics solver which is based upon the Finite-Difference Time-Domain (FDTD) method and an X-window graphical user interface (GUI) to simplify the problem setup and definition. The electromagnetics solver was written in FORTRAN and the user interface was written in the scripting language TCL/TK. The codes can be used together to analyze a variety of electromagnetic problems including scattering, radiation, coupling and biological SAR computations. These codes are at a production level and will be made available to users at their request subject to export control restrictions set forth by the United States Air Force.

A STUDY OF THE TILT ANGULAR ANISOPLANATIC CORRELATION AND ITS EFFECT ON THE FULL APERTURE TILT MEASUREMENT TECHNIQUE WITH A LASER GUIDE STAR

Mikhail S. Belen'kii
Principle Research Scientist
Electro-optics, Environment, and Materials Laboratory
Georgia Tech Research Institute

Abstract

A tilt angular anisoplanatic correlation is studied both theoretically and experimentally. It is shown that a tilt angular correlation scale is determined by the ratio of the telescope diameter to the effective altitude of the turbulent atmosphere, and it diminishes with decreasing telescope diameter. Variations of the outer scale of turbulence essentially affect a tilt angular correlation. Therefore, a finite size of the outer scale of turbulence should be taken into account to obtain reliable estimates for the tilt angular aisoplanatic correlation. A tilt angular anisoplanatic correlation is weakly sensitive to the functional form of the vertical profile of the refractive index fluctuations. To verify the results obtained a Moon-edge jitter experiment, which permits us to study a tilt angular correlation for a variable angular separation between the observation points and a variable telescope diameter is designed. A preliminary analysis of the measured data show that they are consistent with the theoretical predictions. Requirements of the parameters of additional telescopes in the full aperture tilt measurement scheme with a laser guide star are determined. It is shown that these telescopes should be small in diameter and should have a wide FOV. A Polar star image jitter experiment that permits us to exclude the effect of uncontrolled telescope motion on the measured data and to study a contribution of the stratospheric turbulence to star image motion is designed.

A THEORY OF THE STRUCTURE OF DOMAIN THEORIES

D. Paul Benjamin
Assistant Professor
Computer Science Department
Oklahoma State University

Abstract

Domain theories are used in a wide variety of fields of computer science as a means of representing properties of the domain under consideration. These fields include artificial intelligence, software engineering, VLSI design, cryptography, and distributed computing. In each case, the advantages of using theories include the precision of task specification and the ability to verify results. As the complexity of systems in these fields increases, these advantages become crucial. A great deal of effort has gone into the development of tools to make the use of theories easier. This effort has met with some success. However, a fundamental problem remains: the choice of formulation for a theory. This paper describes fundamental research on the representation of domain theories. The perspective of this work is to view a problem's state space as though it were physical space, and the actions in the state space as though they were physical motions. A domain theory should then state the laws of motion within the space. Following the analogy with physics, a representation is a coordinate system, and theories are transformed by changing coordinates. The mathematical basis for this analogy is given, and illustrated on two simple examples.

ADAPTIVE INTERFACES

Kevin B. Bennett, Ph. D.
Associate Professor
Psychology Department
Wright State University

Abstract

A "dynamically adaptive interface" (DAI) is a computer interface that changes the display or control characteristics of the system (perhaps both) in real time as a function of several alternative sources of information, including system performance, contextual variables, and the current workload of the operator. The goal of dynamically adaptive interfaces is to anticipate informational needs or desires and to provide that information without the requirement for an explicit control input by the user. If properly designed DAI's have the potential to improve overall human machine system performance; they also have the very real potential to degrade performance. The fundamental challenge in designing effective DAI's is to provide dynamic changes in displays or controls that provide the right information at the right time. A collaborative research program to explore both theoretical and practical issues in dynamically adaptive interfaces has been initiated. This final report describes a conceptual framework for the development of adaptive interfaces, a DAI that has been developed to assist in precision low level navigation tasks (e.g., instrument landing), and an experimental program to evaluate that interface.

Advanced controls (a force reflecting stick) and displays (a flight director display) have been incorporated into the dynamically adaptive interface concept demonstrator. The force reflecting stick uses the haptic perceptual channel to provide feedback with regard to the optimal landing path (thus, it is not only a control, but also a display). The visual display is a redesign of the Flight Director (FD) that provides a single configural format with all information relevant to the landing task (designed to be consistent with the display principles of "correspondence" and "coherence"). To establish DAI's as a legitimate area of research and, eventually, as an effective tool for design, it must be shown that dynamically adaptive interfaces improve overall system performance. Therefore, three experimental groups are included in the proposed evaluation: the traditional interface group (conventional controls and displays always present), the advanced interface group (advanced controls and displays always present), and the dynamically adaptive advanced interface group (advanced controls and displays that are included or excluded dynamically). The timing of these adaptive changes is determined by the quality of performance, current or anticipated contextual variables, and the real-time measurement of psychophysiological indices of workload. The work completed during the SFRP represents a step towards understanding the theoretical and practical issues in a potentially useful interface design concept.

Virtual Dislocations

Victor Berdichevsky
Professor
Wayne State University

Abstract

Some phenomena is solid mechanics, like brittle-ductile transition can be explained by spontaneous generation of dislocations when temperature exceeds some critical value. To develop theory of such phenomena, one has to know energy of dislocations in inhomogeneous stress field. This expression is derived and discussed in this paper from various perspectives. This paper is the first one in the series of papers on spontaneous nucleation of dislocations caused by change of temperature and/or external stresses.

INVESTIGATION OF THE SPINNABILITY OF SPECIALTY POLYMERS

Gajanan S. Bhat, Assistant Professor
University of Tennessee, Knoxville

Abstract

There was a special need to produce fibers with some unique combination of properties and for this two polymers which are not usually spun into fibers were selected. As the polymers were not designed for spinning, it was important to study their processability in a melt spinning set-up. The polymers were investigated for their properties and attempts were made to spin them using a home-built spinning set-up. Findings from the processing studies of these polymers are documented. The two polymers investigated were, Ultem, a high temperature polyetherimide resin, and a popular commodity resin polymethyl methacrylate (PMMA). Although both of these are commercially available resins, they are mainly engineering plastics, and pose problems during the fiber formation process. Form the rheological studies, it was evident that Ultem can be spun at high temperatures. However, use of high temperature also causes the problems of degradation, leading to gelation and slow hole formation. PMMA also has a narrow window of processing temperature due to its low degradation temperature. For both the polymers it was shown that one can produce decent quality fibers when spun under well controlled conditions.

A STUDY OF X-RAY FLUORESCENCE ANALYSIS OF LEAD IN PAINT

Verne L. Biddle
Chemistry Professor
Department of Chemistry
Bob Jones University

Abstract

The assay of lead in paint samples was studied, using a Kevex XRF 770 Spectrometer and a Kevex Analyst 8000 data processor. Relative standard deviations and accuracy were significantly better for ground paint than for paint chips. The mass of the sample in the XRF cup was determined to not be extremely important, as long as it was not much less than about one gram. A least squares calibration curve, obtained from a series of ELPAT paint samples, was used for quantitation.

Analysis of standard ELPAT paint samples using XRF gave very good results, as did the analysis of spiked samples. The detection limit was well within the range necessary to ascertain lead content as it pertains to lead abatement programs. A number of field samples of paint were analyzed and compared with XRF analysis of the paint chips and with the standard ASTM digestion-AA method. Multilayered paints exhibited the greatest differences for the various methods, especially if they contained significant amounts of lead. Based on the good correlation with known paints analyzed simultaneously as method checks, XRF analysis of ground paint (particles passing a 100-mesh sieve) was shown to be as good as or superior to the presently used AA method. Also demonstrated was the importance of grinding the paint sample, even for the AA method Software that was PC-based was found to be more easily used, faster, and more adaptable to the present application than was the software presently in use in the Analyst 8000.

TOWARDS THE REAL-TIME EXECUTION OF TURBINE ENGINE SIMULATION PROGRAMS

Csaba Biegl
Research Assistant Professor
Vanderbilt University
Department of Electrical Engineering

Abstract

The Arnold Engineering Development Center (AEDC) uses a variety of turbine engine simulation programs to enhance its testing capabilities. Traditionally, these models have been executed off-line, sometimes at processing speeds which are several orders of magnitude slower than the speed of the physical processes they model. Increasing demands for faster test turnaround times and data accuracy necessitate the integration of on-line simulation into the testing process. This paper describes two efforts towards this goal: a graphical user interface which is intended to speed up user interaction with the models, and a parallel processing toolkit used to convert some of the existing AEDC models for parallel execution.

An Analysis of Adaptive DPCA

Rick S. Blum

Assistant Professor

Department of Electrical Engineering and Computer Science

Lehigh University

Abstract

A low complexity space-time adaptive processing (STAP) scheme, called the adaptive displaced antenna (ADPCA) technique is analyzed. Conditions under which this scheme is optimum are given for the case of observations with a known covariance matrix. These conditions can be satisfied if exactly two pulses are used in the ADPCA scheme, but they can not be satisfied for ADPCA schemes which use more than two pulses. An interesting interpretation of the ADPCA scheme is provided which may explain its good performance for some airborne surveillance radar problems. For some cases with noise and ground clutter only, the ADPCA scheme approximates a pulse canceling scheme applied to optimally processed pairs of pulses. The approximation is exact for cases where the clutter is produced by ground scatterers with zero azimuth angle. In other cases considered the approximation error was found to be quite small for cases where the clutter is produced by ground scatterers with any azimuth angle. The detection performance was analyzed for a case where the training data does not include the effects of a scatterer that produces clutter in the range cell under test. Here the ADPCA scheme outperforms scheme which is optimum for the case of a known covariance matrix.

EVALUATION OF:
I. DEFENSE TECHNOLOGY INDUSTRIAL BASE FORECASTING MODEL
II. S&T IPPD AFFORDABILITY GUIDE
III. ROADMAP REVIEW SEMINAR
IV. AFFORDABILITY WORKSHOP
V. METRIC FOR AGILE VIRTUAL ENTERPRISES
VI. AGILE LABOR UNIONS FOR VIRTUAL ENTERPRISES
VII. DECISION SUPPORT SYSTEM FOR THE MANAGEMENT OF AGILE SUPPLY CHAINS - PHILIPS LAB

H. Marshall Booker
Professor
Economics and Finance
Christopher Newport University

Abstract

This report provides an overview and evaluation of several select and different projects reviewed while on assignment at Wright-Patterson Air Force Base Manufacturing Technology Directorate. (MT). All seven programs under study are related in some way or another, but more specifically through affordability issues, Integrated Product and Process Design, Agile Enterprise, and/or best business practices associated activities. An effort is made in the following pages to describe each activity and to then evaluate the activity from the perspective of an educator with thirty years experience in the field, and then to render recommendations with regard to programs and processes where appropriate.

Learning is a continuous process where informational gain is measured in output performance characteristics and is critical as a survival guide in the new change oriented environment of the modern competitive world. Frederich Hegel, the philosopher, argued that the only constant in this world is "change" itself. To understand and deal with change is to realize the full advantages of affordability and economic justification among competing resources. New technologies, new products, and new processes will propel us to a new era of survival.

COMPUTER SUPPORTED COLLABORATIVE WORK ENVIRONMENT FOR REQUIREMENTS ANALYSIS PROCESSES IN DESIGN OF WEAPON SYSTEMS

Dr. Alexander Bordetsky
Department of Decision Sciences
School of Management
University of Texas at Dallas

ABSTRACT

The Requirements Analysis Process in Design for Weapon Systems (RAPID-WS) is a research initiative within the Armstrong Laboratory to improve critical aspects of the DoD weapon systems acquisition process, specifically aimed at improving the requirements process. The proof of concept produced by this research is the RAPID-WS computer system which is characterized by its underlying database management system, graphical user interface, software supporting individual/stand-alone computers, and supporting hardware.

The kernel of existing process for RAPID-WS is represented by Pre-Milestone 0 and Pre-Milestone 1 activities of the DoD acquisition process . These activities include the mission area analysis process as well as the drafting and coordination of certain high-level requirements documents.

Due to the shared electronic document workspace and mixed asynchronous/real-time computer communication features, desktop video conferencing provides the maximal flexibility for distributed group of Action Officers to process all major steps of milestone. It also gives maximum flexibility and highest potential for sharing such applications as a stand alone RAPID-WS, word processor, spreadsheet, modeling, and simulation software.

The subject of this *research* is to study the efficient ways of computer supported collaborative work integration into the Pre-Milestone 0-1 part of the general Acquisition Process. The primary *research tasks* that are addressed in this work include the demonstration of how computer supported collaborative work based on desktop video conferencing technology may be accomplished during the requirements generation process, experimental evaluation of new Pre-Milestone 0-1 related teamwork activities that emerge in computer supported collaborative environment , experimental evaluation of how a defined set of distributed collaborative work tools will support the requirements generation process, experimental evaluation of possibilities to integrate these tools into the RAPID-WS environment, and design of a coordination protocol.

ARTIFICIAL INTELLIGENCE IN AIR FORCE PCB TEST

Nazeih M. Botros
Associate Professor
Department of Electrical Engineering
Southern Illinois University

Abstract

In this research, we investigated the implementation of Artificial Intelligence (AI) in automatic testing of Printed Circuit Boards (PCBs). Five major AI tools have been considered for this implementation: Fuzzy Logic, Genetic Algorithm, Artificial Neural Networks (ANNs), Hybrid Artificial Neural Networks, and Expert Systems (ESs). Three major types of automatic tests have been considered; they are: Depot testing, Signature identification testing, and X-ray and electromagnetic testing. For each test we assigned the most efficient AI tools and recommended the way the test should be conducted. The finding of this research will be implemented as a road map for the Air Force in investing in AI for automatic test.

COMPUTER SIMULATIONS OF SYNCHRONOUS AND ASYNCHRONOUS MULTI-USER OPTICAL CODE DIVISION MULTIPLE ACCESS DIGITAL COMMUNICATION SYSTEMS

Dr. Daniel C. Bukofzer, Professor and Chairman
Department of Electrical and Computer Engineering
California State University
Fresno California 93740-0094

Abstract

This report presents performance results of digital communication systems that support multiple users using a specific optical code division multiple access (O-CDMA) technique. These performance results are obtained strictly via computer methods utilizing block oriented simulation software. More specifically, both synchronous (same bit rate per user) and asynchronous (different user bit rates with unrelated clocks) systems have been studied via simulation in which multiple users using bipolar codes obtained from a cyclically shifted maximal length sequence transmit signals simultaneously by on-off modulating carriers at set frequencies. (For most simulations these frequencies were set from 2 MHz upward in steps of 2 MHz). Tests were performed assuming both an ideal channel and a non-ideal channel which was modeled as a soft nonlinearity. Although many parameters could be varied in each simulation run, such as the number of users and their bit rates, carrier frequencies and their associated guard bands, receiver filter characteristics and bandwidth, photodiode efficiency factor, and channel nonlinear characteristics, because of report limitations, only a few of the performance results obtained are shown here. Varying the above parameters iteratively would produce many more performance plots than could be presented in this report. Therefore the results focus on describing the simulation system and demonstrating the development of a series of lower hierarchical level software implementations that yield appropriate results for the systems being considered. In most cases, the key results involve demonstrating the appropriate recovery of the bit stream of each of the users, and the effect on performance when specific system parameters as described above are varied. The work completed can be and is intended to be used as the starting point for more sophisticated performance testing efforts in which systems involving a greater number of users operating under various operational scenarios can be simulated to include the effect of noise as well as varying the parameters described above.

Theoretical Investigation of Two New Types of Cold Cathode Emitters

M.Cahay
Associate Professor
Department of Electrical Engineeering
University of Cincinnati

ABSTRACT

Ensemble Monte Carlo simulations of electron transport through a new Aluminum Gallium Nitride/Gallium Nitride ($AlGaN/GaN$) cold cathode emitter are reported. We analyze the energy spectrum of carriers prior to being injected in a low workfunction slab of Lanthanum hexaboride (LaB_6) as a function of the ramp energy of the carriers at the $AlGaN/GaN$ heterojunction. Plasmon scattering is found to be the major scattering mechanism in the structure leading to substantial shift towards the low kinetic energy end of the energy spectrum of the carriers injected into the low workfunction Lanthanum hexaboride thin film. Intervalley scattering is found to dominate in the depletion layer at the GaN/LaB_6 interface. Design improvements to increase the efficiency of the cold cathode are suggested.

Simultaneously, we have analyzed a new cold cathode emitter which consists of a thin wide bandgap semiconductor material sandwiched between a metallic material and a low workfunction semimetallic thin film. We show that under forward bias operation the electrons captured in the low workfunction material are responsible for an effective reduction of the semimetallic film workfunction together with a substantial increase of the cathode emitted current. The dynamic workfunction shift is shown to increase with the amount of injected current. Potential material candidates are suggested to achieve low-voltage (< 20 V), room-temperature cold cathode operation with emission currents approaching 100 A/ cm^2 and large efficiencies.

ELECTRIC MACHINES FOR ADJUSTABLE-SPEED DRIVES

J.J. Carroll
Assistant Professor
Department of Electrical and Computer Engineering
Clarkson University

Abstract

This summary compares the various types of electric machines used in high-performance variable-speed drive systems. The machines considered include: (i) brush dc, (ii) ac induction, (iii) synchronous and switched permanent magnet, and (iv) synchronous and switched reluctance motors. The focus of comparison will be placed on energy efficiency and servo control response (i.e., position and/or speed).

Assessing Salience of Aspects of Real-World Images with a Neurophysiological Model of Early Vision

Marc L. Carter
Assistant Professor
Department of Psychology
University of South Florida

Abstract

Current models that predict the effects of laser exposure on human observers consider many factors, but one important factor that has been considered less often is the location of fixation relative to objects (and hence the laser source) in a scene, even though the location of fixation is itself a powerful determinant of laser exposure effects. The project described here develops a model for predicting the location of fixation in real-world scenes by combining several currently fashionable hypotheses about the structure and function of early vision in humans. The model functions in essentially three stages: The first stage employs spatially isotropic difference-of-Gaussian (DOG) filters to produce edge enhancement of objects in the scene. The second stage uses oriented Gabor filters at several spatial scales to produce maps of intensity-by-orientation; these maps are then combined into one map that shows blobs of varying size and intensity. A simple algorithm is then employed to rank-order the blobs in terms of intensity and area, thus providing a principled model of areas of high contrast within the scene, which areas are likely to be a determinant in the location of fixation.

Employing Analogies to Enhance Conceptual Knowledge Acquisition

Richard Catrambone
Associate Professor
School of Psychology
Georgia Institute of Technology

Abstract

An approach to aiding the acquisition of conceptual knowledge has been developed that is being applied to the Stat Lady probability and statistics computerized training environment. This approach uses analogies to help learners understand concepts. A careful decomposition of the curricular elements taught via Stat Lady produced a breakdown of the to-be-learned knowledge into three types: symbolic, procedural, and conceptual. Prior work has shown that the Stat Lady environment is useful for aiding the acquisition of symbolic and procedural knowledge, but not as effective in aiding the acquisition of conceptual knowledge. Relevant research has suggested that learners can acquire new conceptual knowledge more effectively if the new knowledge is systematically tied to pre-existing knowledge through the use of analogies. Thus, the work described in this document tests a principled approach to aiding the acquisition of conceptual knowledge in a computerized training environment.

MESOSCALE MODEL EXPERIMENTS ON CLOUD SHADING EFFECTS

Chia-Bo Chang
Associate Professor
Department of Geosciences
Texas Tech University

Abstract

This study examined the distribution of cloud fraction associated with the PSU/NCAR MM4 model and the effects of cloud shading on short-range mesoscale numerical weather prediction. These effects were evaluated using real-data model simulation experiments. The experiments conducted were as follows:

1) Experiment 1 was a 12-h MM4 forecast with the complete model physics. Low, middle, and high cloud fraction were parameterized based on relative humidity.

2) Experiment 2 was similar to Experiment 1 except without the effects of cloud shading.

3) Experiment 3 was similar to Experiment 1 except that the model cloud fractions were determined based on relative humidity in conjunction with the model cloud water.

Results indicated that without the effects of cloud shading the model surface temperatures were too high and consequently the model atmosphere became less stable causing erroneous convection. Also, cloud shading tended to enhance the low-level baroclinicity between the cloudy and clear areas. The involvement of cloud water in Experiment 3 reduced the total cloud cover and resulted in a better simulation of surface flow field in this case.

THE BALLISTIC RANGE AS A TOOL FOR VALIDATION OF UNSTEADY COMPUTATIONAL FLUID DYNAMIC CODES

Gary T. Chapman
Adjunct Professor
Department of Mechanical Engineering
The University of California, Berkeley

Abstract

Unsteady computational fluid dynamics (CFD) codes are beginning to be used to analyze unsteady aerodynamics problems like store separation, and have the potential for many other applications. Some potential applications are: Control system design and evaluation, and the study of the effects of atmospheric winds on vehicle aerodynamics and flight dynamics and control. To be a viable tool in these roles CFD codes need to be validated with experimental data. Wind tunnel and flight testing to obtain data suitable for validation of unsteady CFD codes is very expensive and time consuming. Ballistic range testing is inherently unsteady and relatively inexpensive. The ballistic range as a tool for CFD code validation is evaluated. The capabilities and costs of the ballistic range testing and some existing data are examined in light of CFD validation.

The Aeroballistic Research Facility at the Wright Laboratory, Armament Directorate at Eglin Air Force Base has the capability to provide high quality trajectory and aerodynamic data and high quality shadowgraphs for precise flow field measurements (e.g., shock shapes) and density fields from interferograms. A set of data is available to provide some preliminary CFD validation. The limitations of this data set are evaluated and suggestions for additional tests and facility capability enhancements are put forward.

AUTOMATIC MOVING TARGETS DETECTION AND ESTIMATION USING CONTAMINATED DATA

Julian Cheung
Associate Professor

Department of Electrical Engineering
and
Department of Computer Science

ABSTRACT

In this paper the analysis of variance (ANOVA) is extended to the representation of multi-frame images. The methodology of the optimal detection of moving objects embedded in noisy environments is presented, yielding ultimately a closed form solution. The new detector makes use of the information of the spatial and temporal effects, and is uniformly most powerful (UMP) in Gaussian environment with unknown and time-varying noise variance.

The new detector is primarily an optical-flow based detector without, however, the drawbacks of the latter; it uses advantageously a feature-based approach to improve the efficiency of computation. The versatility of the proposed detector is demonstrated by the fact that, with an adjustment of system parameters, it is applicable to multi-spectral detection and stationary-objects detection. It is also shown that all well-known detectors, generally classified as feature-based or optical-flow-based, become subclasses of the new detector if the proposed detector is subjected to more restrictive conditions.

Performance of the proposed detector is fully supported by extensive real image simulations.

REACTOR ANALYSIS FOR TREATMENT OF WASTE WATER CONTAINING AQUEOUS FILM-FORMING FOAM (AFFF) WITH FENTON'S REAGENT

D.-T. Chin
Professor
Department of Chemical Engineering
Clarkson University
Potsdam, New York 13699-5705

ABSTRACT

The U.S. Air Force uses Aqueous Film-Forming Form (AFFF) as a fire suppressant for aircraft storage and maintenance hangars and in fire training exercises. Following a fire-fighting event, the foam is washed-down with water. Release of AFFF to drainage systems has an adverse effect to environment and to municipal sewage treatment operation. AFFF may be decomposed by reacting with Fenton's reagent, which is an aqueous solution of H_2O_2 and a ferrous salt at pH 2 to 4.

This report describes a reactor analysis for treating AFFF-contaminated water with excess Fenton's reagent. Sixty thousand gallons (60,000 gal) of waste water containing 2% of AFFF is to be treated in 20 working days and the concentration of AFFF in effluent waste water is to be reduced to 0.02%. Mass and energy balance and heat transfer analysis are made to estimate reactor volume and cooling requirement over a range of an apparent reaction rate constant from 0.001 to 1.0 $M^{-1}min^{-1}$. Three types of reactors are considered: i) batch reactor; ii) continuous stirred tank reactor (CSTR); and iii) multiple tank cascade. The analysis leads to the following conclusions:

1. To carry out one batch operation per a 12-hour work day, a reaction rate constant of 0.01 $M^{-1}min^{-1}$ and a batch reactor of 6,400 gal in volume are needed for the treatment. The required heat transfer area of tank cooling coils and cooling water flow rate are: 155 ft^2 and 8.5 gal/min, respectively.
2. CSTR needs a large reactor volume because of low concentration of AFFF and H_2O_2 in the reactor. It is more economical to operate the CSTR at a large reaction rate constant of 0.1 $M^{-1}min^{-1}$. With this rate constant, the required reactor volume, cooling coil area and cooling water flow rate will be 5,500 gal, 35 ft^2 and 1.9 gal/min, respectively.
3. In multiple tank cascade, the total reactor volume is substantially reduced by connecting a number of small tank reactors in series. With a reaction rate constant of 0.01 $M^{-1}min^{-1}$, five tanks of 800 gal in volume are needed for continuous treatment of waste water. If the reaction rate constant is increased to 0.1 $M^{-1}min^{-1}$, only three tanks of 200 gal in volume are needed for the treatment. The required heat transfer area and cooling water flow rate in each tank are approximately 19 ft^2 and 1 gal/min, respectively.

TRANSPORT OF ATM-BASED TRAFFIC VIA THE ADVANCED COMMUNICATION TECHNOLOGY SATELLITE (ACTS)

Mostafa Chinichian
Electrical Engineering Department
California Polytechnic State University
Grand Avenue
San Luis Obispo, CA 93407

ABSTRACT

These tests will perform as a link test between the two stations, the CRC, Ottawa and Rome Labs, GAFB, New York. Equipment configurations for the ATM tests as well as channel characterization in term of C/No and BER as a function of other ATM parameters in a single channel and multiple channels are studied. Performance analysis are also includes plots for the different QPSK and 8-PSK modulations with or without error correcting coding.

A Feasibility Study For Re-Manufacturing Aircraft Structural Components Using Laser Scanning And X-Ray Computed Tomography

Joe G. Chow and Ramesh M. C.[1]

Associate Professor
Department of Industrial and Systems Engineering
Florida International University

Abstract

In the past few years, non-contact digitization systems have become a very popular means to rapidly re-manufacture commercial products, molds and dies, and industrial parts. This popularity can be attributed to continual improvement in the accuracy and reliability of these systems. In this study, a feasibility was initiated to investigate the re-engineering and re-manufacturing capabilities of two non-contact digitization techniques, laser scanner and X-Ray computed tomography and to evaluate the feasibility of using these techniques to reduce part turnaround time at Warner Robins Air Logistics Center. The study includes an in-depth survey of two state-of-the-art laser scanning systems, along with re-engineering and re-manufacturing practices with these systems. The significant findings from this study include the following :

- Laser scanning technologies have matured to a stage that they can capture and reproduce intricate surface details typically present in the aircraft structural components.

- Laser scanning technologies, through both re-engineering and re-manufacturing approaches, can dramatically reduce part turnaround time and skill levels required to re-manufacture aircraft structural components at WR-ALC.

[1] Ramesh M. C. is a graduate student at Georgia Tech who assisted Dr. Joe Chow in conducting the laser scanning project during Summer 1995.

MULTI-OPERATOR PERFORMANCE AIDING

Gerald P. Chubb
Assistant Professor
Department of Aerospace Engineering, Applied Mechanics, and Aviation
The Ohio State University

Abstract

Performance aids can be viewed as any means of compensating for know human limitations in sensory, perceptual, cognitive, or motor performance capabilities. Such aids can assist or support the performance of problem solving, decision making, choice selection, or simple procedure execution. The aid can be built-into the designed system, supplied as a personal equipment item, provided as part of combat mission folder materials, or incorporated into published Technical Orders (e.g. checklists in the Flight Manual).

Multi-operator systems have a horizontal and/or vertical organizational structure. Systems with multiple crew members are a horizontally organized multi-operator system. Bombers, tankers, and transport aircraft well represent this class, but only some fighters have two crew members. Vertically organized multi-operator systems include interactions among cooperating, coordinating, or collaborative systems, such as between tanker and refueling aircraft, between flight lead and wingman, between bomber and command center, between AWACS and interceptor, etc.

Performance aids can assist operators in virtually any phase of the mission, from takeoff to landing. Examples for improving existing aids and proposed concepts for new aids are presented as possible candidates for further research. Emphasis is placed on adopting a three-tiered approach to test and evaluation of aid effectiveness: 1) performance predictions based upon theory and modeling, 2) empirical studies in laboratory and simulator exercises, and 3) cross-validation of models and products in well-instrumented and carefully designed flight tests.

Probing $V_{In}(PH)_4$ in InP with Electron Paramagnetic Resonance

Dennis P. Clougherty

Department of Physics University of Vermont Burlington, VT 05405

Abstract

Electron paramagnetic resonance (EPR) is proposed as a technique to search for the presence of the hydrogen complex $V_{In}(PH)_4$, conjectured to be a donor impurity in InP. A vacancy model is proposed to describe the electronic structure of $V_{In}(PH)_4$. In the absence of a pseudo Jahn-Teller effect, an isotropic g value near the free electron value is predicted. The hyperfine interaction arising from the Fermi contact term on the H sites can be modeled by an effective spin Hamiltonian. The EPR signature of the presence of the $V_{In}(PH)_4$ complex is five transitions in the first-order hyperfine structure which are approximately isotropic. The effect of isotopic substitution ($H \rightarrow D$) is discussed.

TIME-OF-FLIGHT MASS SPECTROMETER SAMPLING SYSTEM FOR AEDC IMPULSE FACILITY

Frank G. Collins
Professor of Aerospace Engineering
Department of Mechanical and Aerospace Engineering
The University of Tennessee Space Institute
Tullahoma, TN 37388

Abstract

Presently there is great interest in developing high enthalpy test facilities for improving our understanding of high speed atmospheric flight and developing accompanying propulsion systems. Typical test facilities, such as the AEDC Impulse Facility, have millisecond run times which are terminated upon arrival of the driver gas, usually helium. A means must be developed for directly measuring the precise moment when the helium arrives in the test section. This can be accomplished with a time-of-flight mass spectrometer. A portion of the test section flow must be sampled, with an isokinetic skimmer system, and fed into the mass spectrometer. The present work describes bench experiments with the mass spectrometer and computations that were performed on a preliminary skimmer system. The skimmer system consists of three co-axial skimmers. The first skimmer must swallow the shock wave and the second must greatly limit the amount of gas which proceeds to the third skimmer. The third skimmer must be in free-molecule flow and define a beam of molecules which enter the mass spectrometer. The flow through the last two skimmers was computed using the Monte Carlo technique.

GENETIC ALGORITHMS AND THE SENSOR MANAGER SCHEDULER

Milton L. Cone
Assistant Professor
Department of Computer Science/Electrical Engineering
Embry-Riddle Aeronautical University

Abstract

A genetic algorithm scheduler is developed that solves a simple sequencing problem. The effect of various crossover and mutation rates on the best ten solutions found and on the average solution of the last generation is presented as a study of 25 experiments. The most important result is that the closer the average solution for the last generation gets to the optimal result, the farther the average of the best solutions is from that optimal result. This suggests using the average of the best solutions and the generation average solution as measures to adjust the crossover and mutation rates to produce a better solution in a fixed amount of time or to arrive at the same solution sooner. These are important considerations if the scheduler is to be used in a real-time system.

A STUDY OF SIMPLE AND EFFICIENT TECHNIQUES FOR LOSSLESS AND NEAR-LOSSLESS COMPRESSION OF DIGITIZED IMAGES

Manohar Das
Associate Professor
Department of Electrical and Systems Engineering
Oakland University

Abstract

This report introduces two simple techniques for lossless and near-lossless compression of digitized images and presents a comparative study of the proposed schemes and some of the existing ones. The proposed new techniques represent adaptive and hierarchical versions of the conventional fixed Differential Pulse Code Modulation (DPCM) scheme. These are called Suboptimal Adaptive DPCM (SADPCM) and Hierarchical Block-Adaptive DPCM (HBADPCM) methods, respectively.

The SADPCM lossless coders are mainly useful for archival and/or transmission of still image frames without loss of any data, whereas their near-lossless versions are suitable for applications where loss of some visually imperceptible details may be tolerable without compromising safety. On the other hand, HBADPCM coders provide efficient tools for hierarchical transmission, which allows either accessing the image at progressively improving quality and/or resolution levels, or accessing it gradually according to preferred areas of interest. Such coders are intuitively appealing because they can achieve significant savings in the overall transmission cost by allowing fast browsing of an image database by reducing the volume of unwanted transmission.

The performances of the proposed coders are compared with two of the most popular existing schemes known as the fixed DPCM and Hierarchical Interpolation (HINT) methods. The results of the experimental studies indicate that both SADPCM and HBADPCM coders perform better than the other methods considered. Since the computational complexities of the proposed coders are reasonably low, it is believed that these should find widespread use in applications involving lossless and near-lossless, or hierarchical image compression.

NON-CONVERGENCE OF STREAMLINE CURVATURE FLOW ANALYSIS PROCEDURES

Stephen F. Davis
Associate Professor
Department of Mathematics and Statistics
Mississippi State University

Abstract

The axial compressor aerodynamics computer program UD0300 sometimes fails to compute the performance of high throughflow, transonic compressor stages. This report describes efforts to determine the cause of this failure. These efforts primarily consist of numerical studies of special cases because the algorithm is too complex to study analytically. These studies indicate that, if an unconverged iterate cannot satisfy the continuity constraint, the iteration algorithm used in the code may not be able to find a solution that satisfies this constraint. Preliminary attempts to modify the algorithm are described and suggestions for additional work proposed.

THE SIMULATION OF X-RAY POLE FIGURES
AND
ORIENTATION DISTRIBUTION FUNCTIONS

by:
Robert J. De Angelis
Department of Mechanical Engineering
University of Nebraska-Lincoln
Lincoln, Nebraska 68588-0656

Abstract

The production of metallic materials with controlled degrees of anisotropy is important because the controlled texture provides significant assurance that subsequent plastic deformation can be performed successfully and reproducibly. To proceed to this condition, the degree of anisotropy must be quantified by the experimental determination of x-ray pole figures and the orientation distribution functions (ODF) calculated from the pole figure data. Orientation distribution functions are plotted in three dimensional Eulerian space which makes it difficult for the casual observer to extract even the simplest texture information from ODF plots. The main objective of this research was to develop a method to simulate x-ray pole figures and orientation distribution functions from materials of any combination of crystallographic textures. Through the use of straight forward overlay techniques the results obtained from the simulations can easily determine the types and strengths of textures that exist in processed materials.

September, 1995

Analysis To Determine The Quality Factor Of A Celestron-8 Telescope

Ronald R. DeLyser
Assistant Professor of Electrical Engineering
Peyman Ensaf
Graduate Student
Department of Engineering
University of Denver

Abstract

Due to geometrical similarities between the Celestron-8 telescope and some of the space telescopes, calculating near fields within the Celestron-8 telescope was important for survivability/vulnerability assessments of space telescopes. In this analysis our goal is to use the software package CARLOS-3D [2], to calculate the near fields within the cavity of the Celestron-8 telescope and compare the results obtained using two different discretizations. This report provides some of the formulations and approaches used for this type of assessment along with the errors in results and some suggested improvements.

UNIDIRECTIONAL RING LASERS WITH MULTIPLE QUANTUM WELL GAIN MEDIA

Jean-Claude Diels
Professor
Department of Physics and Astronomy

University of New Mexico
800 Yale Blvd. NE
Albuquerque, New Mexico 87131

ABSTRACT

Multiple Quantum Well gain structures have been designed and grown with a finite gain (equal in both directions) a zero reflection from one side, and a finite reflection from the other side.

INVESTIGATION OF FRANZ-KELDYSH OSCILLATION, PHOTOLUMINESCENCE DECAY AND SPECTRUM, AND SECOND-ORDER NONLINEAR OPTICAL DEVICES IN SEMICONDUCTOR STRUCTURES

Yujie J. Ding
Assistant Professor
Department of Physics and Astronomy
Bowling Green State University

Abstract

We present a new technique that accurately extracts the bandgap from Franz-Keldysh oscillations (FKOs) by perturbing the internal electric field of a SIN structure or a laser PIN diode with a second, unmodulated laser pump. FKOs observed when the sample is illuminated by this perturbing pump shows small shifts in the peak energies relative to those in the unperturbed FKOs. These shifts are analyzed, using only linear least-square fitting, to provide both the phase and the critical point energy in the asymptotic expression for the FKOs. The technique works even when the near-bandgap spectrum is distorted. We have applied the perturbed photoreflectance technique to GaAs surface-intrinsic-n-doped (SIN) structures and to laser PIN diodes. In the SIN sample, we extract bandgaps within several meV of the expected values of the band-gaps. We have particularly tested our technique on the laser PIN diode. We extract the bandgap of the AlGaAs confinement barriers corresponding to an Al composition of 18% in good agreement with the nominal value.

We have measured the photoluminescence decay of various coupling structures of quantum wells. We have determined the carrier densities for band-filling effects.

We have measured photoluminescence spectrum of an asymmetric-coupled quantum-well structure. We have observed that the ratio of the first two heavy-hole transition strengths increases as the pump intensity increases due to nonlinear coupling of the wells.

We have designed a structure for demonstrating transversely-pumped counter-propagating (mirrorless) optical parametric oscillation and amplification, and achieving surface-emitting second-harmonic generation in a vertical cavity.

ELECTRO-REFRACTION AND ELECTRO-ABSORPTION IN POLED POLYMER FILMS

Vincent G. Dominic
Assistant Professor
Electro-Optics Program
University of Dayton

Abstract

We developed and analyzed a new technique to simultaneously measure electro-refraction and electro-absorption in poled-polymer Fabry-Perot cavities. Both effects generally contribute to the measured signal from such material systems and we distinguish them by rotating the étalon and observing asymmetric peaks in our signal. We found the expected increase in both electro-refraction and electro-absorption as the probe wavelength approaches the absorption band of the chromophore. We also observed an oscillation in the electro-absorptive signal that we identified as multiple-étalon interference. This multiple-étalon interference artifact will pollute most of the standard electro-optic characterization techniques for poled-polymer films.

ION-MOLECULE REACTIONS AT VERY HIGH TEMPERATURES

Itzhak Dotan
Associate Professor
The Open University of Israel
16 Klausner St.
Ramat-Aviv, Tel-Aviv
Israel

Abstract

Rate coefficients for a few ion-molecule reactions have been measured in the range 300-1500K. The measurements were carried out in a flowing afterglow apparatus designed for the measurement of ion-molecule reaction rate coefficients at temperatures higher than any previous measurement. Reactions measured were $Ar^+ + CO_2$, $Ar^+ + SO_2$, $N^+ + O_2$, $CO_2^+ + O_2$. These results are compared with previous studies of temperature and translational energy dependence of ion-molecule reaction rate coefficients. Preliminary results were obtained for the reactions $O^+ + N_2$, $Ar^+ + O_2$, $N_2^+ + O_2$. Experimental problems relating to operation of a flowing after-glow apparatus at high temperatures were solved and discussed.

A GC-MS STUDY OF QUANTITATIVE DETERMINATIONS OF AMPHETAMINES AND METHAMPHETAMINES AND THE REMOVAL [BY PERIODATE OXIDATION] OF POSSIBLE INTERFERENCE BY EPHEDRINE

W. DROST-HANSEN
Professor of Chemistry
Department of Chemistry, University of Miami
Coral Gables, FL. 33124-0431

ABSTRACT

In the GC-MS determination of the following drugs of abuse (DA), amphetamine (AM) and methamphetamine (MAP), ephedrine (EP) is known to interfer, in particular because of the sometimes excessive concentrations of the latter compound [which is an Over-the-Counter (OTC) item] found in urine and blood samples. Earlier work by Buddha Paul et al. has suggested that the EP (and pseudo-ephedrine and propanolammine) may be removed by periodate oxidation. The present study was undertaken to test this suggestion and delineate more specifically the optimal conditions for this process.

FILE AFREP95U

AN INVESTIGATION OF THE EFFECT OF POST-FABRICATION PROCESSING ON THE MICROSTRUCTURE AND PROPERTIES OF A SiCp - 6092 Al COMPOSITE

Indranath Dutta
Associate professor
Department of Mechanical Engineering
Naval Postgraduate School

Abstract

The evolution of microstructure and mechanical properties of a 17.5 vol.% SiCp reinforced 6092 Al - matrix composite during post-fabrication deformation processing was studied. The effects of process temperature and strain rate were investigated. The objective was to determine whether appropriate process conditions can yield matrix grain refinement via particle stimulated nucleation (PSN) of recrystallization in addition to achieving particle redistribution during extrusion, and whether such grain refinement has a positive impact on the resultant properties. It was found that following processing, the tensile properties of the composite were significantly improved. Some grain refinement was also achieved, and the material with the highest likelihood of PSN of recrystallization appeared to have better fracture properties than a control material where no PSN was expected. Further, it was found that the fracture behavior of the composite can be substantially altered by appropriate heat treatment following processing, with properties ranging from brittle to tough behavior being obtainable.

TRANSITION AND SEPARATION COMPUTATIONS ON TURBINE BLADES

Elizabeth A. Ervin
Assistant Professor
Department of Mechanical and Aerospace Engineering

Abstract

A numerical study of turbine blade flows was conducted. The primary focus of the study was to study the effect of low Reynolds number flows, typical of low pressure turbines at cruising altitudes, on transition and separation. Prior experimental investigations have shown a greater tendency for transition and separation at lower Reynolds. Numerical results confirm these findings. The influence of pitch to axial chord ratio was also considered.

SUBSTITUTE CLEANING AGENTS FOR CFC113 IN OIL AND GREASE REMOVAL FROM AIRPLANE PARTS

Marvin Fleischman
Professor
Department of Chemical Engineering
University of Louisville

Abstract

Organic and aqueous based materials were screened as potential replacements for CFC-113 in removing oil and grease during maintenance and repair operations of airplane parts, as per various technical orders (T.O.). An outside contractor will validate the substitute materials/processes. CFC-113 a chlorofluorocarbon, is an ozone depleting substance (ODS) whose manufacture is now banned under the Montreal Protocol. The comparative performance of each candidate cleaning agent with respect to CFC 113 was determined by flushing or ultrasonic cleaning of contaminated steel coupons based upon: qualitative solubility tests; percent weight removal of oil, grease and oil/grease mixture; Auger spectroscopy for surface analysis; and visual inspection. The screening tests showed the following candidates to be less effective than CFC 113: Dry Wipes (no solvent), Deionized Water, Alkaline Cleaner (EZE 445), OS-20 (methyl polysiloxane), OS-30, n-Methyl Pyrollodine, Isopropanol, Citrikleen HD Spray & Wipe, & Penair HD-1 (terpene). The following candidates were almost, as, or possibly more effective than CFC 113: Aliphatic Naptha, AK225 (hydrochlorofluorocarbon), and DS 108 Wipe Solvent (petroleum solvent mixture).

Use of Statistical Process Control in a Repair/Refurbish/Remanufacture Environment With Small Lot Sizes

Roger G. Ford, Ph.D., P.E.
Associate Professor of Engineering
Department of Engineering
St. Mary's University

Abstract

The repair/refurbish/remanufacture environment of the repair depot at Kelly Air Force Base is a non-traditional manufacturing operation aimed at the maintenance of the Air Force's aircraft. Since maintenance of used aircraft entails the disassembly of the aircraft and components of the aircraft, inspection of the parts for wear replacement or repair, refurbishment and reassembly, testing, and return to the users, the variability of the functions necessary to repair the aircraft is high. With small lot sizes, high variability of the work load, and long cycle times, traditional use of statistical process control is very difficult or inappropriate. The assessment of statistical process control in this unique manufacturing environment was the aim of this project.

The use of statistical process control in the San Antonio Air Logistics Center was investigated as to the present use of the discipline as of the summer of 1995, the appropriateness of that present use, the correctness of the present use, the potential use of traditional statistical process control techniques, the potential use of non-traditional statistical process control techniques, and the areas where the use of statistical process control is not recommended.

Five directorates in the facility were investigated. The use of statistical process control was almost non-existent at the time of the project. Potential implementation areas for statistical process control are enumerated for each directorate, the various techniques for non-traditional use of statistical process control are identified with the areas for potential use, and the proper sequencing of the implementation of the statistical process control techniques for small runs, attribute charting, and variable charting are given.

The impact of statistical process control at Kelly is discussed in relation to defense downsizing, the Base Realignment and Closure Commission, and privatization at Kelly Air Force Base. Conclusions and recommendations are included.

DETERMINATION OF THE UTILITY OF THE BERKELEY IMAGING SPATIAL INTERFEROMETER FOR AIR FORCE NEEDS AND A POSSIBLE TEST OF THE ATMOSPHERIC FROZEN SCREEN MODEL OF TURBULENCE

Jeffrey Foster Friedman
Assistant Professor
Department of Physics
Recinto Universitario Mayagüez
University of Puerto Rico

Abstract

We (Gary Loos[*], Manfred Bester[#], William Junor[*+], Jeff Friedman[^|]) have examined the Berkeley Imaging Spatial Interferometer (ISI)[1-8] in terms of its light sensitivity and tracking capabilities to determine if it is adequate to acquire and track satellites that may be of interest to the Air Force. The goal is to acquire satellite interference fringes using the ISI heterodyne detection scheme at 11.1μm and to use these fringes when the third element of the ISI is installed to resolve images of the satellites.

In addition I have begun investigating a dual frequency laser metrology/atmospheric disturbance experiment design to determine if local atmospheric distortions are carried by the near field wind as in the frozen screen model. The utility of this determination would make it possible to place a detector down wind of an interferometer and post detection correct for some significant portion of the of the atmospheric distortion introduced into the signal. The method relys on a nonuniform change in the index of refraction of air at different frequencies with a change in temperature (and pressure).

* Phillips Laboratory PL/LIMI
# University of California, Berkeley
+ Rockwell Power Systems
^ AFOSR Summer Faculty Research Program
| University of Puerto Rico; Mayagüez

INTERACTION OF MATRIX CRACKING AND INELASTIC DEFORMATION IN CERAMIC COMPOSITES

Zhanjun Gao
Department of Mechanical & Aeronautical Engineering
Clarkson University
Potsdam, NY 13699

and

Joseph R. Zuiker
Wright Laboratory Materials Directorate
WL/MLLN Bldg. 655
2230 Tenth Street, Suite 1
Wright-Patterson AFB, OH 45433-7817

ABSTRACT

The interactions of matrix cracks and inelastic deformation of an eight-harness satin weave (8H SW) Nextel 610/Aluminosilicate ceramic matrix composite is studied. A variational approach is proposed to derive a nonlinear differential equation for the stress function which represents the stress field of the composite. The Green's function of the nonlinear differential equation is then obtained. Using the Green's function and a constitutive equation, a two-dimensional stress and creep strain states in the woven composites are evaluated. This new microcracking/inelastic deformation analysis is more accurate than previous attempts at the same problem. The predicted creep strain of the woven composite shows good correlation with experimental data at different levels of temperature and stress conditions.

A CASE STUDY FOR THE INTEGRATED PRODUCT AND PROCESS DESIGN GUIDELINE

Richard J. Gerth
Assistant Professor
Department of Industrial and Manufacturing Systems Engineering
Ohio University

Abstract

The Integrated Product and Process Development (IPPD) Guide is a design guideline to help 6.3 development programs consider cost and risk issues in their technology development efforts. The guideline is based upon modern quality and concurrent engineering concepts and techniques as used by leading commercial industries, such as Motorola and Texas Instruments. My duty was to write a case study, based on an actual development program that highlights the manner in which the IPPD guide functions. The case study served 3 purposes:

1. identify missing steps
2. test the guide procedures for consistency and flaws
3. create an example from which the interrelationships of the guide steps can be understood.

In addition, appendices and descriptions of the specific tools were written.

The case study revealed many problems and issues that were addressed and resolved. The major unresolved issues are:

1. The manner in which the Air Force pays contractors, i. e., a profit margin based on a percentage of cost, encourages the contractor to increase costs to increase profits. A fixed contract fee where the contractor can increase profits by decreasing cost, similar to the commercial market, may be preferable.
2. It may be difficult to implement the concurrent engineering approach in the early stages of the design process (prior to the PR - purchase request) because contractors, who are the immediate customer of 6.3 development programs, cannot be included in the process until the PR is released. This requires that some sort of in-house manufacturing and design expertise be available during the early planning stages.
3. Cost and risk are prominent criteria within the guidelines, but are not well integrated with traditional performance measures because of a lack of a generally accepted integrating framework. It has been proposed to represent the risk by stating a range for each performance requirement, and to estimate the cost associated with each requirement separately. Unfortunately, for most requirements there are no quantitative methods to estimate the associated cost and risk.

A STUDY OF VARIOUS HALOGEN-FREE OXIDIZERS AND OXIDIZER MIXTURES

Vincent P. Giannamore
Assistant Professor
Department of Chemistry
Xavier University of Louisiana

Abstract

Hydroxylammonium dinitramide (HADN) was prepared by the previously developed method. The method was reviewed and suggestions regarding the procedure have been made. The material prepared is now under study on several fronts. Five ternary mixtures of energetic, oxidizing salts were made and their thermal and impact behavior studied. Three of them appear to have properties worth pursuing, although a number of questions remain unanswered. Only preliminary work was done on hydroxylammonium nitroformate (HANF). A proposed purification method was suggested.

COMPARATIVE EFFECTS OF DYNAMIC AND STATIC STRENGTH TRAINING ON $+G_Z$ TOLERANCE

Ellen Glickman-Weiss
Associate Professor
Department of Kinesiology
Louisiana State University

Abstract

The comparative effectiveness of generalized dynamic resistance strength training and specific static resistance strength training in enhancing relaxed, gradual onset rate (GOR) $+G_Z$ tolerance and +4.5 to + 7.0 G_Z simulated air combat maneuver endurance is the focus of the present investigation. Because of the muscular efforts demanded of individuals during repeated performance of the AGSM during high +Gz conditions, physically untrained individuals will fatigue earlier than their physically trained counterparts. Thus, the protective effect of general strength training programs on $+G_Z$ endurance has indicated enhancement of $+G_Z$ endurance in strength-trained subjects. Additionally, results by the Russians indicated that static force generated by a pilot during a progressive test of sustained, static leg press was highly predictive of $+G_Z$ tolerance. Thus, it was the purpose of the present investigation to compare these training regimes as to serve as an important step in responding to the flying community's request for a physical training program which enhances $+G_Z$ endurance and also reduces aircrew training time involvement. The present investigation has not been completed, and is ongoing, thus no final results are reported at present.

DETERMINING STATISTICAL VALIDITY OF SAMPLE SIZE AND FREQUENCY IN ANALYZING TOXIC AIR CONTAMINANTS IN A PRODUCTION ENVIRONMENT

James Ervin Glover, Ph.D.
Associate Professor and Chairman
Department of Mathematics
Langston University

Abstract

The accidental emission or release of various kinds of toxic or hazardous air pollutants into the atmosphere over the years has resulted in serious health consequences and even death. These have included particulate matter from volatile and semi-volatile organic compounds and others, both known and unknown. It has become a distinct necessity to control and even eliminate the hazardous effects of these and other sources of pollution. There must be a solid, well-planned, scientific approach to the modeling and validation testing of emissions reduction systems both nationally and worldwide. In particular, the metal casting industry has committed itself to a resolution of this problem by effective and prompt treatment and disposal of process residues, while containing or reducing costs. Such an effort necessarily requires extensive sampling and testing of the ambient atmosphere. The purpose of this research effort is to contribute to the theoretical foundation for a sampling plan which validates the selected sample size, test frequency, and methodology to ensure that samples of the lowest volume of the total air emission field provide data which are statistically sound or valid.

ANALYSIS OF TURBULENCE MEASUREMENTS BEHIND A BLUFF BODY FLAME HOLDER AND IN A HIGH SWIRL DUMP COMBUSTOR

Dr. Richard D. Gould
Associate Professor
Dept. of Mechanical & Aerospace Engineering
North Carolina State University

ABSTRACT

The following two technical papers concerning laser Doppler velocimeter (LDV) measurements in the flow behind a bluff body flame holder were co-authored with WL/POPT scientists as part of this summer assignment. Since the first paper is 11 pages and the second is 7 pages, both in 9 point double column format, they will not be included here due to space limitations.

"Simultaneous 3-D LDV Measurements in the Isothermal Flow Behind a Bluff Body Flameholder," with C. N. Raffoul and A. S. Nejad, *12th International Symposium on Air Breathing Engines*, Ed. F. S. Billig, Melbourne, Australia, pp. 1045 - 1055, 1995.

"Investigation of Three-Dimensional Turbulent Transport Behind a Bluff Body," with C. N. Raffoul and A. S. Nejad, *ASME 1995 Separated and Complex Flows,* FED-Vol. 217, pp. 121-128, 1995.

In addition, further analysis of the two component LDV and single point temperature measurements made during the summer of 1992 in the highly swirling flow field of a model dump combustor was also performed during this assignment. A lean propane-air diffusion flame with an overall equivalence ratio of $\phi = 0.45$ was stabilized in the combustion chamber by the flow pattern of the Wright Laboratory/Rolls Royce (WL/RR) swirler for this study. A complete description of this flow and the measurements made are given in this report. In particular, the time averaged temperature measurements made using a type S Platinum/10% Platinum-Rhodium thermocouple probe were corrected for radiation losses. Also, a numerical mass flux balance was performed at each axial station and was found to give agreement to within ±20%.

AN ALTERNATIVE TO SILANE COUPLING AGENTS AS ADHESION PROMOTERS: ADMICELLAR POLYMERIZATION OF STYRENE-ISOPRENE ON GLASS CLOTH FOR USE IN COMPOSITE MANUFACTURE

Brian P. Grady
Assistant Professor
Department of Chemical Engineering
University of Oklahoma

Abstract

A new method for promoting the adhesion of thermosetting resins to a reinforcing agent was successfully demonstrated. In this method, termed admicellar polymerization, monomers are polymerized inside a surfactant bilayer adsorbed on a surface. Admicellar polymerization is essentially the surface analogue of emulsion polymerization. This method has significant advantages over current silane coupling technology, primarily admicellar polymerization is less expensive and more robust.

In this study, glass mats were coated with styrene-isoprene copolymers using admicellar technology and the resulting composites made with polyester or epoxy resin were compared to the silane and untreated counterparts. *For both types of resins, the composite made from the admicellar treated material had a higher average ultimate strength than the composite made from the untreated material.* In the epoxy material, the improvement was close to that provided by the coupling agent. Since the admicellar polymerization process was not optimized, the significant conclusion of this study is that admicellar polymerization improves the adhesion between the resin and the reinforcing filler in a thermosetting composite; however the maximum amount of improvement has not yet been determined.

MANIFESTATIONS OF THE STRESS DRIVEN REARRANGEMENT INSTABILITIES IN CREEP, DAMAGING AND FRACTURE

Michael A. Grinfeld
Research Professor of Mechanical and Aerospace Engineering
Department of Mechanical and Aerospace Engineering
Rutgers University

Abstract

Recent explosive progress of the theory of stress driven rearrangement instability of solids has provided researchers with conceptually new approaches and ideas, and it has allowed to attack successfully many old and modern problems in different branches of materials science. In this study the ideas and mechanisms of the stress driven rearrangement instability of solids are incorporated in the problems of creep, damaging and fracture of solids. These ideas permit to explain simply and naturally the phenomena like nucleation dislocations, initiation of cracking in initially perfect crystalline solids, spatio-temporal localization of damaging; also, without any doubts they allow to present primary, secondary and tertiary creep as a coherent string of inherently connected physical phenomena rather than a manifestation of independent mechanisms of creep. We formulate and investigate conceptually new and relatively simple governing systems of equations allowing to investigate linear and nonlinear stages of the stress driven rearrangement instability and we believe that this study provide researchers with new approaches to the problems of creep, fracture, localization and life-time prediction.

Modeling and Control of Rotating Stall and Surge for Compressor Systems in Turbojet Engines

Guoxiang Gu
Department of Electrical and Computer Engineering
Louisiana State University, Baton Rouge, LA 70803-5901

September 26, 1995

Abstract

The primary goal of this summer faculty program is the participation of the application research in propulsion related problem. This problem is chosen as the rotating stall and surge in axial flow compressors because of its importance to Air Force mission and to the improvement of the preformance for future aeroengines. Our primary goal has been accomplished successfully at the completion of the summer faculty program. Over 50 research papers have been studied, and four chapters of lecture notes written. Moreover this summer faculty program helped greatly the transition from theoretical oriented research for linear control to application oriented research for nonlinear control that is in the mutual interest of the faculty development and the Air Force Laboratory. This final report summarizes the research work performed at WL/FIGC of the Wright-Patterson Air Force Base by the author during the summer of 1995, sponsored by AFOSR Summer Faculty Research Program. The research objective is to study the rotating stall and surge phenomena in compressor systems that limit the performance of turbojet engines. Roughly speaking, rotating stall is a two-dimensional disturbance localized to the compressor and characterized by regions of reduced or reversed flow that rotate around the annulus of the compressor, while surge is characterized by violent one-dimensional oscillations in the annulus averaged flow throughout the compression system. Both rotating stall and surge are undesirable operating conditions, and can not be tolerated during the compressor operation. In the past two decades, there is a significant development in modeling the rotating stall and surge, and it is only in the past a few years, linear and nonlinear control methods have been employed to actively suppress the rotating stall and surge. The research work performed during this summer faculty program deepened our understanding, and prepared us to undertake research work in the rapidly developing research field of active control for rotating stall and surge in axial flow compressors.

A CLOSED-CYCLE CW PHOTOLYTIC IODINE LASER USING t-C_4F_9I

John A. Guthrie
Assistant Professor
Department of Physics
University of Central Oklahoma

Abstract

Perfluoro-t-butyl iodide, t-C_4F_9I, offers at least three potential advantages as a replacement perfluoroalkyl iodide for many of those currently in use in photolytic iodine lasers, such as normal and iso-C_3F_7I. First, the perfluoro-t-butyl radical displays a large overall recombination rate with atomic iodine relative to other alkyl iodides; this property limits production of the contaminant I_2 in the laser medium. Second, the ultraviolet absorption peak of t-C_4F_9I is shifted about 16 nm to the red of that for the more common perfluoroalkyl iodides, such as n-C_3F_7I; this feature offers the prospect of much greater efficiency in absorption of radiation from the excitation lamp. Finally, because t-C_4F_9I has a lower vapor pressure than most other perfluoro compounds used in photolytic iodine lasers (PIL's), there exists the possibility of designing a laser system for which the laser gas requires no condensation/evaporation scheme in order to promote flow of the gas; elimination of this complicated flow mechanism will yield much more efficient and physically compact PIL's.

A closed-cycle continuous-wave (CW) photolytic iodine laser using t-C_4F_9I has been built and operated for the first time as a result of this work. The t-C_4F_9I gas, at pressures near 17 torr, was flowed transversely to the laser beam axis using a turbomolecular blower. A microwave-excited mercury lamp was the laser pump source. The laser demonstrated a maximum multimode output of 2.9 W which corresponded to about 0.6% conversion efficiency of the pumping radiation. During operation the system displayed a monotonically decreasing output power with time due to the continuous production of molecular iodine, which quenched the upper state of the laser transition. Further work will center on development of improved methods to minimize production of molecular iodine, and to remove it efficiently from the iodide gas stream. Success in these efforts will make lasers based on t-C_4F_9I viable alternatives for those currently based on normal or iso-C_3F_7I.

Development of a Fluorescence Post-Labeling Assay for DNA Adducts

Joseph Guttenplan
Departments of Biochemistry and Environmental Medicine
New York University Dental and Medical Schools
New York, NY 10010

Abstract

Methods for detecting low levels of relatively small DNA adducts are currently limited. Probably the most frequently used method is a ^{32}P-post labeling assay. This assay, although very sensitive for large hydrophic DNA adducts, is less sensitive for smaller adducts and has the disadvantage that it requires the use of considerable radioactivity. Adducts likely to be formed by compounds of interest to the Air Force will probably fall into the class of smaller adducts. Thus, there is a need for an alternate assay. One potentially sensitive method for detecting such adducts is a fluorescence post-labeling assay. This method would couple a highly fluorescent label to deoxynucleotides (dNMPs) prepared by digesting the DNA. The fluorescent nucleotides would then be analyzed by HPLC. Because the label can be selected for a high quantum yield of fluorescence, the method should be extremely sensitive (low fmol detection). When the project was initiated there was only one reported method for fluorescent labeling of dNMPs and this was the starting point for the project. That method utilized a carbodiimide coupling with dNMPs, the replacement of the carbodiimide with ethylenediamine (ED) and the derivitization of the free amino group with dansyl chloride. The method was carried out using normal dNMPs, but proved less than satisfactory. The major difficulty with the method was interference from the hydrolysis product of dansyl chloride (dansyl sulfonic acid) and from the reaction product of ED with dansyl chloride. In order to reduce the concentrations of these products, the excess ED was removed. This was accomplished by releasing the free base and lyophilizing the mixture before addition of the dansyl chloride. This not only reduced the concentration of the ED-dansyl chloride product, but also allowed a dramatic reduction in the concentration of dansyl chloride. This was possible because the concentration of this reagent had to be in excess of the concentration of free amino groups, and the bulk of these came from the excess ED. A further improvement in the assay was brought about by utilizing a different fluorescent label, Fluoram. In contrast to dansyl chloride, this compound yields a nonfluorescent hydrolysis product. As a result the major interfering peak was eliminated and a very clean chromatograph was obtained.

In order to test the modified method it was necessary to synthesize appropriate standards of modified dNMPs. These were produced by reacting high concentrations of either chloroacetaldehyde (CA) or chloral hydrate (CH) with the dNMPs. CA is known to from DNA adducts, but less is known about CH. HPLC analysis of the reaction products revealed that CA and to a lesser extent, CH gave rise to modified dNMPs in sufficient yield to be collected for use as standards. Thus, at this point the methodology has been worked out to evaluate the fluorescence post-labeling assay on DNA adducts of the type produced by chlorinated aliphatic compounds.

PART I: FINAL DEVELOPMENT OF SURFACE-OBSTACLE INSTRUMENT FOR SKIN-FRICTION AND FLOW DIRECTION MEASUREMENT

PART II: EXPLORATORY STUDY OF A NEW CONCEPT FOR FLOW SIMULATION AT HIGH MACH NUMBERS

Raimo J. Hakkinen
Professor and Director, Fluid Mechanics Laboratory
Department of Mechanical Engineering
Washington University

Abstract

PART I: The technical background of surface-obstacle skin friction meters were thoroughly reviewed during the 1993 Summer Program, and the emphasis of the 1994 Summer Program was to complete the detailed design of a specific instrument, to initiate its fabrication, and to define test programs for facilities available at Wright Laboratory (WL) and Washington University (WU). These objectives were completed, and fabrication of the instrument was approved at Wright Laboratory. However, during the 1995 summer program, the fabrication and the calibration tests tentatively planned for the WL M3 and M6 supersonic wind tunnels could not be scheduled. Using a simple proof-of-concept prototype instrument manufactured under private funding, a series of incompressible-flow calibration data was acquired in the Washington University Low-Speed Wind Tunnel in April, 1995. Summaries of all previous work and the new incompressible calibration data were presented in a USAF-sponsored international symposium in July, 1995. The 1995 Summer Program effort reported in Part I consisted primarily of a detailed analysis of the 1995 Washington University data. The resulting correlations of incompressible calibration data obtained in a flat-plate boundary layer at one laminar and two turbulent conditions essentially verify the calibration characteristic of the new instrument postulated in earlier work.

PART II: The second part of the 1995 Summer Program Final Report describes a preliminary feasibility study of a new hypersonic test facility concept. For further information on this item, please contact Norman E. Scaggs, WL/FIMO.

Fiber-optic Sources for Communications and Control

J. W. Haus
Physics Dept.
Rensselaer Polytechnic Institute
Troy, NY 12180-3590

Abstract

Fiber-optics technology has become a cornerstone for advanced information communications in both the military and the civilian sectors. The availability of mode-locked fiber-optic sources would provide compatibility with existing fiber-optic structures and an inexpensive alternative to sub-picosecond semiconductor sources in this wavelength regime. In this program we have continued to develop a unique capability in the simulation of mode-locked fiber-optic sources. I have endeavored to examined several avenues to creating reliable mode-locked laser sources and improving their behavior.

I have also proposed a novel mode-locking scheme using fiber Bragg gratings that is being examined for implementation in the laboratory. The research is a collaboration with James Theimer at Rome Labs and is designed to support ongoing experiments of Reinhard Erdmann and my student, Walter Kaechele, who working is at Rome Labs.

Two papers were prepared and submitted for publication during the summer program. Conference papers have been accepted at the Optical Society Annual Meeting and further conferences have been identified to disseminate research results. Other aspects of the summer research are being completed after the program's end.

EFFECT OF HUMIDITY ON WEAR OF M-50 STEEL WITH A DEMNUM LUBRICANT

Larry S. Helmick
Professor of Chemistry
Department of Science and Mathematics
Cedarville College

Abstract

Using a Cameron-Plint tribometer under controlled environmental conditions, wear of M-50 steel with a Demnum (a linear perfluoropolyalkyl ether) lubricant was studied under boundary lubrication conditions at 50 and 150 C with relative humidity ranging from 1% to 95%. In general, both wear and friction decrease sharply as humidity is increased from 1 to 5%, then are constant as humidity increases to 95%. Thus, wear is highly dependent on humidity when relative humidity is less than 5%. Wear at low humidities for this lubricant, which does not contain difluoroacetal groups, is compared to wear previously reported for Fomblin Z, a linear perfluoropolyalkyl ether containing difluoroacetal groups.

GAS CHROMATOGRAPHY/MASS SPECTROMETRY OF PERFLUOROPOLYALKYLETHER BASED LUBRICATING OILS

David W. Johnson
Associate Professor
Department of Chemistry
University of Dayton

Abstract

Gas chromatography/mass spectrometry has been used to separate and identify the individual oligomers in the perfluoropolyalkylether based lubricants; Krytox 143 AZ and two low molecular weight fractions of Krytox 143 AC. Based on the mass spectrometry, the molecular weight of the individual oligomers can be determined. Gas chromatography/mass spectrometry has also been used to determine the degradation product of a lubricant additive in another perfluoropolyalkylether based lubricant; Fomblin Z. Mass spectrometric data indicates that the degradation pathway proceeds through the formation of an acid fluoride as the first step. The second step in the degradation adds a ketone functional group to the molecule.

RELIGIOSITY, SUBJECTIVE HEALTH AND HEALTH BEHAVIOR
AMONG A SELECTED RETIRED POPULATION

Glenda Stein Johnson
Assistant Professor
Division of Natural Sciences
Dillard University

Abstract

Health professionals and researchers have begun to consider man's religious practices and beliefs as significant factors in health and as an influence in integrating positive health behavior into individual lifestyles. The relationship of religiosity to subjective health and health protective behaviors were examined in a convenience sample of 58 retired male and female United States Air Force (USAF) members living in two Air Force retirement communities. Only a few significant associations between religiosity and specific health behaviors in this sample were observed. No significant association was found with any of the dimensions of religiosity and subjective health. These findings are discussed in relationship to sample characteristics.

SIMULATION STUDIES OF ULTRAFAST SILICON AVALANCHE SHAPER (SAS) DEVICES FOR HIGH POWER SWITCHING

R. P. Joshi
Department of Electrical & Computer Engineering
Old Dominion University, Norfolk, VA 23527-0246

Abstract

The primary goal of this research effort was to conduct a theoretical study and numerical analysis of the Silicon Avalanche Shaper (SAS) devices. The SAS devices are important integral components of an overall semiconductor-based high-power switching technology that is being developed at the Phillips Laboratory. A physical, microscopic mathematical model for these devices was developed. A one-dimensional time-dependent simulation code was subsequently set up for numerical analysis and performance predictions. Results obtained from this work indicate the theoretical possibility of sub-nanosecond current rise times. Such current pulses would provide for the high-power, ultrashort electrical waveforms necessary for the generation of electromagnetic signals. The role of internal impact ionization, the time-dependent internal displacement current within the SAS device, and the propagation dynamics of an "electric field wave" were analyzed. The simulation results are in keeping with the general qualitative trends that have been observed in the experimental work so far. Potential for future continuation of the theoretical work in this area of high-power, non-photoconductive switching technology was identified. Some follow-on research issues have also been discussed.

CONTAINERLESS PROCESSING OF
SINGLE (PST) CRYSTALS OF LAMELLAR TiAl

Bimal K. Kad
Research Scientist
Department of Applied Mechanics & Engineering Sciences
University of California-San Diego

Abstract

Containerless growth of single poly-synthetically twinned (PST) crystals of $\alpha_2+\gamma$ lamellar crystals was carried out with a view to obtaining oriented single crystals of Ti-49at%Al composition, that have their lamellar plates aligned parallel to the growth direction. The anisotropy of crystal growth, in the prescursor α-hcp phase, was employed to orient the basal plane parallel to the growth direction, thereby yielding the desired lameller orientation. Experimentally, the liquidus composition was zone leveled in the intial transients, to ensure L ->α solidification while avoiding L->β solidification.

THEORY AND APPLICATION OF THE PRINCIPLE OF FREQUENCY SHIFTING OF A SOURCE WAVE BY A SWITCHED TIME-VARYING MAGNETOPLASMA MEDIUM

Dikshitulu K. Kalluri
Professor
Department of Electrical Engineering
University of Massachusetts Lowell
Lowell, MA 01854

Abstract

The author of this report had investigated earliert some aspects of the transformation in the properties of an electromagnetic signal brought out by a switched time-varying magnetoplasma medium. The main effect of switching the medium is the splitting of the source (incident) wave into new waves whose frequencies are different from the incident wave frequency. The author has solved the following three frequency-shifting related research problems during the summer of 1995:

A. Developed a perturbation technique to find the reflection coefficient of the upshifted wave due to rapid creation of a plasma medium and relate it to the rise time of the electron density profile.

B. Completed the study of the phenomenon of the frequency upshifting and power intensification of a whistler wave due to the decay of the electron density.

C. Completed the study of the phenomenon of the conversion of the whistler wave into a helical magnetic wiggler field when the strength of the static magnetic field decays with time.

These topics are of immediate interest to the Ionospheric Effects Division of Phillips Laboratory at Hanscom in connection with their investigations on lightning induced effects in the ionosphere. One of the important parameters in these investigations is the time-varying plasma frequency due to the transient enhancement of the ionization. To focus on this effect, a simplyfying assumption is made that the plasma is spatially homogeneous and unbounded.

FATE AND TRANSPORT OF ORGANIC SOLUBLE PLUMES FROM SITES 260 AND 280 OF THE HILL AIR FORCE BASE, UTAH

Jagath J. Kaluarachchi, Ph.D.
Associate Professor
Department of Civil and Environmental Engineering and
Utah Water Research Laboratory
Utah State University

Abstract

Sites 260 and 280 are located in the Hill Air Force Base, Ogden, Utah, and Site 260 is used as a storage location for diesel fuel oils since 1958. Presently Site 260 has six active diesel fuel underground storage tanks (USTs). In August of 1993, free-phase JP-4 jet fuel was detected at these sites at a depth of 109 feet below the ground surface. Since January of 1994, free-product recovery has been performed and a total of 4500 gallons of fuel have been recovered. Present daily recovery from these sites is approximately 50 gallons. Preliminary analysis of organic chemicals in ground water showed the presence of both volatile and semi-volatile compounds in excess of maximum contaminant levels (MCLs). The goal of this study was to investigate the fate and transport of BTX (benzene, toluene, xylene) plumes in ground water under different scenarios and to assess the potential impacts to ground water over time. The analysis was performed using the limited site-data collected by the consultants and using the model BioTrans. The results of the analysis suggested that natural attenuation is possible at the site. However the excessive oxygen demand especially beneath the free-product plume cannot be met with the ambient oxygen in ground water. Enhanced bioremediation through oxygen injection is more promising and should be investigated as a suitable corrective action. Since this analysis was performed under limited site-specific data needed for the model, the results should be used qualitatively. For future corrective action designs, more site-specific data needed for modeling should be collected and used in conjunction with pilot studies to ensure an effective corrective action plan can be implemented.

DETERMINATION OF CHEMICAL OXYGEN-IODINE LASER SCALING REQUIREMENTS FOR LASER MATERIALS PROCESSING

Aravinda Kar
Assistant Professor
Department of Mechanical and Aerospace Engineering
Center for Research and Education in Optics and Lasers
University of Central Florida

Abstract

A simple mathematical model of thick-section stainless steel cutting with a high power Chemical Oxygen-Iodine Laser (COIL) is presented and compared with experimental results obtained with a 10-kilowatt COIL at the U.S. Air Force's Phillips Laboratory. This model uses a lumped-parameter technique to relate the cutting kerf depth with various process parameters and can be used to predict the laser power scaling requirements for carrying out laser materials processing of very thick sections. The model is similar to an empirical model developed by researchers in Japan, but includes predictive capabilities for thick metal cutting at verly low velocities. The effects of various process parameters such as laser power, spot size and dimensions, and processing speed on the cutting depth are discussed and demonstrated. Finally, the ramifications of this model on thick-section processing of metals are presented, with emphasis on potential applications of COIL to high-speed, thick stainless steel cutting.

Since the natural shape of a typical Chemical Oxygen-Iodine Laser (COIL) beam is rectangular with several modes, a three-dimensional quasi-steady-state heat conduction model is presented to understand the basic mechanisms of heat transfer in the workpiece during materials processing with such complex beams.

A STUDY OF SUPER CAPACITOR APPLICATIONS

Marian K. Kazimierczuk
Professor
Department of Electrical Engineering
Wright State University
Dayton, OH 45435

Abstract — The feasibility of the use of a super capacitor and DC/DC converter to improve the regulation of the bus voltage of an aircraft was studied. A boost DC/DC converter was used to transfer the energy from the capacitor to the dc bus voltage level. A buck DC/DC converter was used to transfer energy from the dc bus to the capacitor. Experimental results indicate that a super capacitor and DC/DC converter can be used to improve the regulation of the bus voltage of distributed power systems.

THEORY OF MONTE-CARLO SIMULATIONS OF THE MAGNETIC CIRCULAR DICHROISM (MCD) SPECTRA OF ALKALI METAL/RARE GAS SYSTEMS

John W. Kenney, III
Associate Professor of Chemistry
Eastern New Mexico University
Portales, NM 88130

Abstract

The history of magnetic circular dichroism (MCD) spectroscopy in the study of alkali metal/rare gas (M/Rg) cryogenic systems is reviewed in the context of developing a better understanding of alkali metal/hydrogen systems of current interest to the U.S. Air Force as enhanced-performance cryogenic rocket propellants. A new theory for simulating the MCD spectra of M/Rg systems is presented together with careful a discussion of the theory's implicit and explicit approximations and their implications. This theory uses a classical Monte Carlo (MC) simulation scheme to model the perturbing effects of the Rg environment on the $^2S \longrightarrow {}^2P$ MCD-active transition of the M atom. The theory sets up the MC-MCD simulation as 6 x 6 matrix eigenvalue/eigenvector problem in the ^2P manifold. This 6 x 6 eigenvalue/eigenvector problem is solved for a number of randomly generated and suitably averaged Rg configurations to yield the simulated MC-MCD spectrum for the M/Rg system of interest.

PART I: EXCAVATOR-MANIPULATOR SYSTEM FOR NEUTRALIZING UNEXPLODED ORDNANCE

PART II: ADAPTIVE SELF-TUNING CONTROL OF EXCAVATORS

A. J. Koivo
Professor
School of Electrical and Computer Engineering
Purdue University

Abstract

Part I: Certain areas for example on beaches can contain unexploded ordnance which can be very dangerous and life-threatening. Therefore the neutralization of such ordnance is essential to make the land useful. After exposing unexploded ordnance, a human usually attaches a rocket-wrench fixture to the fuze of the detonating mechanism. Cartridges attached to this fixture can then be fired to remove the fuze from the ordnance. Since it is dangerous and potentially life-threatening to work in the close neighborhood of unexploded ordnance, a robotic system is designed here to perform the foregoing task of placing the specific fixture around the ordnance.

The mechanical system consists of two robotic manipulators. They can be mounted on the same platform which is attached to an excavator as an end-effector. The excavator will transfer the robotic system close to the ordnance. Then, the motion of the dual-arm system can be guided by a teleoperator so that it will transfer the rocket-wrench to and around the fuze, where the jaws of the wrench assembly will be tightened for grasping the fuze. To control the dual-arm manipulator, an architecture for the teleoperated system is presented.

Part II: To automate the digging operations of an excavator, an adaptive feedback controller is designed here so that the bucket pose tracks a specified trajectory. The controller is determined by minimizing the expected value of the squared tracking errors and the consumed energy subject to a difference equation constraint. The latter represents the input-output relations of the excavator dynamics. In this time-series difference equation, the estimated parameter values are used. The resulting controller is in a feedback form, and the gains depend on the last (best) parameter estimates. Thus, when a new set of parameter estimates are calculated on the basis of the latest measurements, the controller gains are changed accordingly (adaptation). The performance of the designed adaptive self-tuning controller is illustrated by simulations.

METAL STRIP POLARIZING FIBERS

Philipp Kornreich
Professor
DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
Syracuse University

ABSTRACT.

We have fabricated and measured the polarization dependence of the transmission spectrum of Metal Strip Polarizing Fibers. The measurements were performed at the Photonics Center of Rome Laboratories. These devices were fabricated by Syracuse University. We have shown that the metals survive the fabrication process. We where able to measure the plasma resonance absorption of the metal strips.

A STUDY OF NOISE EFFECTS IN PHASE RECONSTRUCTION FROM PHASE DIFFERENCES

Thomas F. Krile
Professor
Department of Electrical Engineering
Texas Tech University

Abstract

Linear phase reconstruction algorithms, which determine phase from phase differences, are used in several areas, such as adaptive optics and speckle imaging. The purpose of this study is to examine the effects of noisy phase difference measurement inputs on reconstructor output phase noise. Both non-phasor and phasor-based path averaging techniques are considered, along with uncorrelated and correlated input noise. Analytic expressions for the output reconstructor noise variance and noise gain as functions of the input noise variance, input noise covariance matrix (for the correlated case), reconstructor matrix and system dimension are shown for the non-phasor case. A procedure for finding an analytic expression for the probability density function of the output noise in a general phasor-based path averaging operation is given for the uncorrelated noise case. Noise performance comparisons between the non-phasor and phasor-based techniques are shown.

Ionospheric Tomography via Iterative Cross-Entropy Minimization

Walter S. Kuklinski
Associate Professor
Department of Electrical Engineering
University of Massachusetts Lowell

Abstract

The problem of reconstructing Ionospheric electron densities from ground-based receiver to satellite TEC (Total Electron Content) measurements is formulated as an underdetermined linear inverse problem. By assuming the Ionospheric electron density is constant in a fixed set of J spatial cells an (Lx1) vector of TEC measurements $\underline{c}$ can be related to a (Jx1) vector of electron densities $\underline{d}$ as: $\underline{c} = A\underline{d}$ where A is an (LxJ) matrix of ray path distances. The algorithm presented here utilized an iterative cross-entropy optimization technique. In this technique the Kullback-Leibler distance between any two nonnegative vectors $\underline{a}$ and $\underline{b}$, $KL(\underline{a},\underline{b})$, is used to define a functional $\alpha KL(P\underline{x},\underline{y}) + (1-\alpha)KL(\underline{x},\underline{p})$ that is minimized using an alternating projection iterative method. The method requires $\underline{x}$ and $\underline{y}$ be nonnegative vectors, related as: $\underline{y} = P\underline{x}$. P is further constrained to contain only nonnegative elements and have unity column sums. $\underline{p}$ is a prior estimate of $\underline{x}$ used to regularize the solution. α allows a tradeoff to be made between data consistency and regularization. Using a factored representaion of $A = PD_C$ where, D_C is a diagonal scaling matrix with elements equal to the column sums of A, the Ionospheric Tomography problem can be transformed to satisfy the convergence criteria of the alternating projection iterative minimization technique.

This algorithm has been evaluated using TEC data corresponding to known incoherent scatter radar electron density measurements. Maximum entropy reconstructions, which did not require a prior estimate of the electron density, and mimimum cross-entropy reconstructions that utilized model electron density data as the prior vector $\underline{p}$ have been produced. The results, which where obtained using a 100 Mhz 80486 processor, required less than 20 seconds of CPU time and less than 8 Mbytes of RAM. The high quality of these reconstructions coupled with computational efficiency of this algorithm indicates the potential utility of this technique for real-time Ionospheric Tomography.

The Check Mark Pattern

Pandu Kulkarni, PhD
Associate Professor of Statistics
Department of Mathematics and Statistics
University of South Alabama

ABSTRACT

We exhibit two studies (one epidemiological and one clinical), both with apparently paradoxical findings characterized by group (index versus control) similarity on the dependent (health) variable (Y) means, a significant group difference on the independent variable (X) means (index mean greater than the control mean) and a positive correlation between Y and X in the index group, causing index subjects with low values of X to have a lower Y mean than the controls and index subjects having high values of X to have a higher Y mean than the controls. This pattern has been called the "check mark" pattern. We predict this pattern using a linear model and use the model to estimate exposure effects in the epidemiologic study. Additionally, we show that a previously published study of the check mark pattern suggesting reverse causation is incorrect.

On the Scintillation of Transionospheric Signals

S. P. Kuo
Professor
Department of Electrical Engineering
Polytechnic University

Abstract

The spectral effect of equatorial ionospheric irregularities on the scintillation of transionospheric signals is considered. A two dimensional periodic density modulation is used to model the bottomside sinusoidal (BSS) irregularity structure found in the equatorial F region. A quasi-particle method is introduced to examine the effect of the spectral width Δk of the density modulation on wave scattering. It is exemplified by calculating the dependence of the scintillation index S_4 of the transionospheric electromagnetic signal on Δk. The parametric dependences of S_4 on the longitudinal and transverse scale lengths of the density irregularities are also presented. The results show that the optimum S_4 depends strongly on $\Delta k / k$. S_4 decreases with $\Delta k / k$ to a minimum, therewith exhibiting a damped oscillation. At the minimum, S_4 reduces to a negligibly small value almost independent of the average scale length of the modulation when the longitudinal scale length of the irregularity is allowed to vary and the transverse irregularity is fixed.

THE SUBSTRATE AND INDUCER SPECIFICITY OF THE NITROBENZENE NITROREDUCTASE PRODUCED BY *PSEUDOMONAS PSEUDOALCALIGENES* JS45

Michael P. Labare

Abstract

Pseudomonas pseudoalcaligenes JS45 uses nitrobenzene as the sole source of C, N, and energy via the incomplete reduction of the nitro group to hydroxylaminobenzene. However, JS45 does not grow on other nitroaromatics (Nishino and Spain, 1993). This study examined the substrate specificity and products formed by the nitrobenzene nitroreductase and the ability of various nitroaromatics to induce production of the nitroreductase. The nitroreductase reduced a wide range of nitroaromatics: 2-, 3-, and 4-nitrophenol; 2-, and 4-nitrobenzoate, 1,2-, 1,3-, and 1,4-dinitrobenzene, 2-, 3-, and 4-nitrotoluene, 2,3- 2,4-, 2,6-, and 3,4-dinitrotoluene, 2-, 3-, and 4-nitroaniline, 4-amino-3-nitrotoluene, trinitrobenzene, trinitrotoluene, nitroquinone, 4-nitrobenzyl alcohol, and 4-nitrobenzaldehyde. Of those tested only 2-nitrobenzoate and 4-nitrocatechol were not reduced to a significant extent. The experiments to determine the products formed from these substrates and their ability to induce production of the reductase are still in progress. The lack of growth of JS45 on nitroaromatics can not be attributed to a limited substrate range of the nitroreductase since the enzyme transforms a variety of nitroaromatics. The substrates may not induce the reductase or the products may be toxic or not substrates for subsequent enzymes in the degradative pathway.

SOLID PHASE MICROEXTRACTION APPLIED TO THE PROBLEM OF FUEL SPILL IDENTIFICATION

Barry K. Lavine
Department of Chemistry
Clarkson University

Abstract

Source identification is an important problem in the field of environmental chemistry. Pollutants must be related to their sources in order to develop effective strategies for the management of the environment. Using headspace/solid phase microextraction/capillary column gas chromatography as an alternative to conventional chromatographic methods, we show that jet fuels recovered from underground sampling wells can be identified as to source. This new approach to fuel spill identification possesses significant potential which can be exploited by the Air Force in its current fuel identification program.

KINETICS OF NETWORK REFORMATION IN HYDROLYTIC DEGRADED AFR700B POLYIMIDE RESIN

Andre Lee
Assistant Professor
Department of Materials Science and mechanics
Michigan state University

Abstract

The kinetics of high temperature curing of hydrolytic degraded AFR700B resin was investigated using dynamic mechanical spectrometry. Upon exposure to moisture, significant degradation on physical and mechanical properties of newly developed high temperature PMR type polyimide resins - AFR700B was observed. In this study we are particular interested in the possibility to re-postcuring of these hydrolyzed resins. Viscoelastic experiments were performed at temperature of 400 ^{o}C and show the isochronal elastic modulus increase at curing time increase. Furthermore, it was possible to perform a time-curing time superposition of these isothermal elastic modulus curves. This time-curing time shift rate can be related to the kinetics of polyimide network formation. Interestingly, in this study we found that the time-curing time shift rate for the hydrolytic degraded samples was identical to the time-curing time shift factor of freshly formulated samples post-cured at the same temperature. This observation does not require the chemistry of cross linking to be the same but only they are of the same control mechanism - diffusion control.

A STATISTICAL ANALYSIS OF LEAD-BASED PAINT SURVEY DATA

Tze-San Lee
Associate Professor
Department of Mathematics
Western Illinois University

Abstract

To identify and assess the lead-based paint (LBP), Galson corporation was retained by the Air Force to conduct the LBP survey. A stratified random sampling was adopted in the survey protocol. Prior to starting the survey, Calson's LBP Survey Manager, in consultation with Base Civil Engineering and Military Housing, reviewed information on construction and painting history for base housing. Based on this review, housing types was placed into different homogeneous exposure groups (HEGs). The Department of Housing and Urban Development (HUD) Interim Guideline was followed to determine the sample size. From each housing group, both the building and the location of painted components to be tested were randomly selected. The LBP survey was performed using SCIETEC Corporation's metal analysis probe X-ray fluoresence spectrum analyzer. A painted component was interpreted to contain lead if the testing result is greater than or equal to 1.3 mg Pb/cm^2, regardless what the duration of the testing was. From the 24 completed LBP surveys of the Air Combat Command bases, four were randomly selected for data analysis. This study indicates: (1) There is a marked variation in the prevalence rate of painted component containing lead in both the between-base and the within-base variation, (2) The HEGs assumption fails to hold for most of the housing groups, (3) The sample size determination used in the survey protocol is not optimal, (4) A systematic sampling with random start would work better than the simple random sampling in selecting the sampled building within the housing group, and (5) A ranking list is constructed for painted components likely to contain lead. This list can serve as a guide in any future LBP survey to select the painted components that are most likely to contain lead.

OPTIMAL CONTROL AND KALMAN FILTER DESIGN FOR SECOND-ORDER DYNAMIC SYSTEMS

Junghsen Lieh
Assistant Professor
Mechanical & Materials Engineering
Wright State University

Abstract

This report describes the process of how the controllers and Kalman filters for second-order dynamic systems can be designed. Both deterministic and stochastic inputs are considered in the control system. It starts with a deterministic case where the linear quadratic regulator is developed. Both full-state and velocity-feedback control laws are discussed. The stochastic case with zero-mean excitation and measurement, which are treated as white noises, is then introduced. The optimal controller and Kalman filter are derived. The use of second-order equation for control design separates position and velocity feedback gains thus will help us understand the control mechanism. The method is further used to determine optimal velocity gains leading to savings in computing Riccati matrices. With only velocities as the feedback signal and measurement data, the data processing time can be shortened and the hardware may be simplified. An example is included, and both full-state and velocity controllers are compared with the passive system.

PARALLEL PROCESSING FOR REAL-TIME RULE-BASED DECISION AIDS

Chun-Shin Lin
Department of Electrical and Computer Engineering
University of Missouri-Columbia

Abstract

The rapid technology development in the past two decades has made today's combat a complicated task. A large amount of information can be available in a mission from both on-board and off-board sources. Effectively utilizing the information is necessary to achieve successful and optimal results. Decision aids that operate in real-time are an important issue as all DoD components strive to reduce the crew size of their various weapon systems. The decision aids will help reduce the workload of the crew and increase the efficiency and reliability of operations. Since a large number of criteria and rules must be evaluated and checked in a very short time period in combat automation, parallel processing may be needed in order to meet the timing requirement. In this project, we investigate a parallel processing technique for complicated decision aids that employ two-state rule-based systems. The study focuses on evaluation of decision rules, although that is just part of the decision aids problem. The rule base is decomposed into subsets for individual processing units. The rule-checking task is distributed to multiple processors to speed up the response. One merit of the explored technique is the scaleability. The number of processors can be altered based on the processing load and the availability of processors. The Intel Paragon high performance computer (a 2-dimensional mesh processor architecture) is selected for experiments. This report introduces the data structures for rule bases and the developed software that was used in this study and which can be used in the future. Experimental results using different numbers of processors are presented.

A STUDY OF DEAD RECKONING AND SMOOTHING IN DISTRIBUTED INTERACTIVE SIMULATION

Kuo-Chi Lin
Associate Professor
Institute for Simulation and Training
University of Central Florida

ABSTRACT

The main objective of the Summer Research Faculty is to make sure the ITB Simulator at Wright Laboratory is DIS compatible in dead-reckoning algorithm. This report analyzes the use of dead reckoning in Distributed Interactive Simulation. The purpose of dead reckoning is to reduce the updates required by each simulator on the network to better utilize the available bandwidth. Extrapolation formulas are derived and discussed. Smoothing and delay compensation algorithms are also discussed. A software tool that assesses the performance of the read reckoning algorithm is introduced. After implementing the body-axes dead-reckoning algorithms, the goal of the Summer Research Faculty is achieved.

DYNAMIC TESTING OF F-16 BIAS AND RADIAL TIRES

Paul P. Lin
Associate Professor
Mechanical Engineering Department
Cleveland State University

Abstract

The main objective of this research was to perform three dimensional tire deformation measurement subjected to different loads, percentages of deflection and yaw angles. The optical technique used is called fringe projection. Unlike Moire Fringes, the proposed technique uses a single light source and one grating, thus requires no image superposition. As a result, the measurement is not as sensitive to vibration as the Moire method does. The other objective was to compare the magnitudes of three dimensional deformation between two types of F-16 aircraft tires made of distinct tire cords: Bias and Radial. The comparison based on some analysis is made in this report, which indicates some difference in tire deformation between these two tires.

MATHEMATICAL MODELING FOR THE THERMIONIC-AMTC CASCADE

M.A.K. Lodhi
Professor
Department of Physics and Engineering Physics
Texas Tech University

Abstract

A Mathematical modeling of a cascade consisting of a TIEC and AMTEC has been performed. The cascade has been broken down in nine nodes. With boundary conditions determined at those nodes, nine simultaneous nodal equations have been constructed and solved by MATHCAD 5.0. View factors for the geometry of the cascade have been calculated and inserted in the appropriate places in the nodal equations. This is done for the first time to our knowledge for this cascade modeling. This effort makes the model relatively more realistic.

AN INVESTIGATION INTO CONSOLIDATING THE MACHINES IN A AND C BAYS FOR SETTING UP MANUFACTURING CELLS IN A-BAY AT McCLELLAN AFB

Rasaratnam Logendran
Associate Professor
Department of Industrial and Manufacturing Engineering
Oregon State University

Abstract

The economic feasibility over a planning horizon of five years is investigated for consolidating the machines currently in A and C bays of the Manufacturing Section at McClellan AFB. The investigation also includes new CNC machines scheduled to be purchased at four different times during the planning horizon. A very attractive nominal internal rate-of-return of 116.36% evaluated suggests the proposed consolidation of machines in A and C bays be undertaken. As the components produced on machines to be consolidated in A-bay are known, a significant amount of data was gathered from the databases available at McClellan AFB and analyzed to either extract or estimate usable elements of data. Such data would be used with the mathematical model proposed to be developed for converting the functional manufacturing (FM) system as it currently exists in A and C bays into a cellular manufacturing (CM) system to be located in A-bay. The fact that one or more of the operations required of some of the components can be performed on alternative machine types creates a challenging problem within the context of converting an existing FM system into a CM system. That is, the proposed model and subsequently the solution algorithm should be capable of *simultaneously* dealing with alternate routing options for the same component while identifying the component and machine assignments to individual manufacturing cells. A host of computer programs would be developed to implement the algorithmic steps on the computer to solve the entire research problem. A proposal for this part of the research would be submitted to the SREP for consideration. The methodology proposed to be developed can also be applied to similar problem environments in other Air Logistic Centers within the Air Force to substantially improve the overall manufacturing productivity.

Studies of Tricresyl Phosphate(TCP) and Its Iron Mixture Using Differential Scanning Calorimeter(DSC)

Christopher C. Lu
Associate Professor
Department of Chemical and Material Engineering
University of Dayton

Abstract

When TCP solution(10mg ~ 20mg) was heated at the heating rate of 10°C/min under the air (or the oxygen) environment, flow rate of 50ml/min, first an exothermic oxidation took place between 200°C and 280°C, followed by an endothermic evaporation occurring at about 320°C, and followed by another exothermic char formation at about 350°C. Finally, the thermal decomposition of char would occur at about 480°C. A sample collected at 250°C had about 50% of TCP (or soluble organic compounds)left, and that collected at 325°C only had 5% TCP left.

When iron powder (about 7mg) was heated at the same conditions described above, there always showed an exothermic peak, at about 300°C under the nitrogen, and about 600°C under the air. These exothermic peaks are probably contributed by the change of crystal structures from alpha or delta to gamma.

EVALUATING ENVIRONMENTAL SYSTEM: CORRECTING FOR THERMAL GRADIENT IN TIME ORDERED REPEATED MEASURES DESIGNS

David A. Ludwig
Associate Professor
Department of Mathematical Sciences
University of North Carolina Greensboro

Abstract

Extension of several difference score approaches for the analysis of time ordered repeated measures experiments involving more than two time periods are presented and discussed. Experiments of this type are commonly encountered in the study of environmental stresses such as heat and cold. The proposed method incorporates statistical correction for the problem of thermal gradient, and is easily understood and interpreted by research workers. It is also mathematically equivalent to more complex and often confusing split-plot repeated measures formats.

ESTIMATING THE SPATIAL DENSITY AND COLLISION RATES FOR THE NEAR-EARTH MAN-MADE ORBITAL DEBRIS ENVIRONMENT

Ronald A. Madler
Assistant Professor
Department of Aerospace Engineering
Embry-Riddle Aeronautical University

Abstract

Determining the current debris population is the first step toward quantifying the hazard posed by natural and man-made debris. Ground-based sensors currently track and maintain orbits of the largest objects in this population, while statistical estimates of the population of smaller objects have also recently been made. The second step toward quantifying the hazard is to use models to estimate future debris populations and the effects they could have on future space operations. The USAF Phillips Laboratory has developed and is improving such a model as part of its space debris research program. The model is called the Debris Environment and Effects Program (DEEP). DEEP is being developed to: 1) estimate a range of possible future debris environments based on a variety of parameters, 2) determine the collision hazard for specific vehicles operating in these environments, 3) determine the effects of potential collisions on vehicle mission performance and 4) evaluate the effects of implementing various options for mitigating man-made debris.

An essential part of any debris environment model is the method used to determine the collision rates between man-made space objects. The methodology behind and some results of the spatial density algorithms used within the DEEP model are discussed.

CREATING ADAPTABLE INFORMATION DELIVERY SYSTEMS FOR TEAM-BASED DISTRIBUTED DECISION MAKING DURING SUSTAINED OPERATIONS: THE APPLICATION OF TECHNOLOGICAL COUNTERMEASURES

Robert P. Mahan
Associate Professor
Department of Psychology
University of Georgia

Abstract

The exponential growth of flexible automated systems is transforming many of the tasks performed by air crew operators into command and control operations. We are seeing air crew teams indirectly controlling large tactical systems via their interaction with computers which now directly control system parameters. Operators must interact with highly flexible technology which provides numerous functions and options for carrying out tasks under different situations. Further, operators must execute these activites under very demanding operational circumstances. Distributed situational awareness in the state of avionic systems embedded in sustained combat scenarios will become a crucial component in mission outcomes, as well as in safety compliance activities, and the avoidance of serious operational hazards. This report serves to introduce a network of ideas that will lead to the development of adaptable systems that can accommodate the complexity of command and control tasks and the psychophysiological state changes that occur during sustained duty. An extended bibliography that provides an extensive literature index is included in the present report.

EVALUATION OF RIB/SKIN FRACTURE IN COMPOSITE ISOGRID

Arup K. Maji
Associate Professor
Department of Civil Engineering
University of New Mexico
Albuquerque, NM 87131

Abstract

Fracture mechanics was used to model failure of the rib/skin connection of composite 'isogrids'. The energy derivative method was used to determine fracture parameters using a general purpose finite element (FEM) program, with an orthotropic material model. The results of the FEM study were correlated with experimental data obtained from flexure tests. The paper explores the concepts of linear elastic and nonlinear fracture as applicable to these graphite/epoxy composite structures. It provides the designers and users of the isogrid with a methodology for quanitfying structural degradation as a function of the rib/skin disbond.

Electronic Shearography (ES) and Environmental Scanning Electron Microscopy (ESEM) were used to observe crack propagation and fracture mechanisms respectively. The applicability of electronic shearography for local and global nondestructive evaluation (NDE) of isogrid structures was also evaluated.

THE MEASUREMENT OF IMAGE POSITIONS IN CYLINDRICAL HOLOGRAMS

James S. Marsh
Professor
Department of Physics
The University of West Florida

Abstract

Using the tool of non-paraxial aberration theory developed by Champagne, a study is made of distortions and aberrations in images reconstructed from cylindrical holograms used in Ballistic Holography. The results are encapsulated in a suite of programs called FNDPNT and ABDIST, which display numerical and graphical results of calculations. The results show that it is generally possible to achieve resolutions of 100 microns or better, consistent with observations on the actual holograms. In general, distortion of the image field in comparison with the object field remains significant, even using 688 nm radiation from a laser diode to reconstruct a hologram made with 694 nm radiation from a ruby laser. However, the routines which form the basis for FNDPNT and ABDIST can be incorporated into measurement software to correct for this inherent distortion.

COMPUTATIONAL STUDIES OF THE REACTIONS OF ATOMIC HYDROGEN WITH FLUOROMETHANES: KINETICS AND BRANCHING RATIOS

Paul Marshall
Associate Professor
Department of Chemistry
University of North Texas
PO Box 5068, Denton, Texas 76203-0068

Abstract

Geometries and vibrational frequencies for transition states in the reactions of H with CH_4, CH_3F, CH_2F_2, CHF_3 and CF_4 have been characterized at the MP2(FU)/6-31G(d) level of theory. The Gaussian-2 methodology yielded barrier heights at the approximate QCISD(T)/6-311+G(3df,2p) level of calculation. The results were employed to calculate rate constants via transition state theory with a tunneling correction. The results are in good accord with experimental rate constants, where these are available for comparison. H-abstraction, F-abstraction and F-substitution pathways were considered, and the results show that, contrary to some earlier assumptions, H atoms react predominantly with the C-H bonds in fluoromethanes and that the major product channel is H_2 production. F atom abstraction is unfavorable kinetically, even though HF formation is the most exothermic pathway. For CF_4 this is the only possible pathway for H-atom attack, which is therefore slow under combustion conditions so that CF_4 is essentially inert in a flame. Thus CF_4 acts mainly as a physical flame suppressant. By contrast, the other fluoromethanes react quickly with H atoms to yield F-containing radicals that undergo further chemistry, which opens the possibility of chemical flame suppression by CH_3F, CH_2F_2 and CHF_3.

SYNTHESIS, PROCESSING, AND CHARACTERIZATION OF THERMALLY CROSSLINKABLE THERMOTROPIC COPOLYESTERS

David C. Martin

Assistant Professor of
Materials Science and Engineering and
Macromolecular Science and Engineering

2022 H. H. Dow Building
Ann Arbor, MI 4 8109-2136

with:

Gary Spilman and Tao Jiang
The University of Michigan, Ann Arbor, MI

Patrick T. Mather and Kevin Chaffee
Philips Laboratory, Edwards AFB, CA

Abstract

The synthesis, processing, and characterization of thermotropic copolymers composed of hydroxybenzoic acid (HBA), hydroxybenzoic acid (HBA), and systematically varying amounts of hydroquinone (HQ) and crosslinkable terephthalic acid (XTA) is described. The XTA monomer contains a benzocyclobutene (BCB) group that lies dormant during synthesis and processing but can be thermally activated to introduce covalent crosslinking between laterally adjacent macromolecules. The XTA-containing HBA/HNA copolymers all remain thermotropically liquid crystalline, and could be processed into oriented fibers by melt spinning. Rheological characterization revealed an increase in the viscosity and a transition from liquid-like to solid-like behavior as the crosslinking reaction proceeds. X-ray diffraction revealed that the microstructure of the XTA containing copolymers was similar to that of neat HBA/HNA, with the extent of crystalline order decreasing slightly with increasing XTA content. TGA experiments show that the HBA/HNA copolymers containing XTA have a decreased onset of thermal degradation temperature, and an increased char content above 700 C.

PRELIMINARY INVESTIGATIONS OF MECHANICALLY INITIATED REACTIONS IN ENERGETIC MATERIALS

James J. Mason

Clark Equipment Assistant Professor
Department of Aerospace and Mechanical Engineering
University of Notre Dame
Notre Dame, IN 46556

Abstract
This report summarizes the activities of the author while studying the effects of dynamic mechanical loading upon ignition and reaction processes in energetic materials at the Advanced Warhead Evaluation Facility (AWEF) at Eglin A.F.B under the Summer Faculty Research Program in the summer of 1995. Some research at the AWEF is currently focused on the effects of dynamic stress state and material microstructure upon ignition and combustion processes in solids. Namely, the effects of dynamic compression, tension and shear loading, and material microstructure are being addressed with particular attention paid to the formation of thermal localizations during deformation. The shock to detonation transition (SDT) is not presently emphasized; rather, lower level stress states are of interest. The primary experimental research methods currently include the torsional split Hopkinson bar, the split Hopkinson pressure bar and the time resolved Taylor impact test. At AWEF experimental investigations are to be complemented by numerical calculations using finite element and finite difference methods. The results of the current work will be useful in understanding the interaction of material microstructure and mechanical properties with the kinetics of deflagration, detonation and initiation of energetic materials. Understanding of the mechanical and microstructural effects can lead to better safety, reliability and reproducibility of the performance of such materials in numerous devices and applications including deep earth and hard target penetrators.

MULTIRESOLUTION SCHEMES FOR SOLVING CONSERVATION LAWS

Peter R. Massopust
Visiting Assistant Professor
Department of Mathematics
Sam Houston State University

Abstract

Multiresolution schemes for the numerical solution of nonlinear partial differential equations of the form

$$\frac{\partial u}{\partial t} + \nabla \cdot f(u) = 0,$$

where u and f are vector-valued functions were investigated. These schemes are based on resolving the numerical fluxes corresponding to f on a nested sequence of increasingly coarser grids and reconstructing them using a combination of direct evaluation and interpolation. This procedure decreases the number of direct (expensive) flux evaluations and this results in a computational speed-up.

AN INVESTIGATION OF THE PRACTICALITY OF THE RAPID ITS DEVELOPMENT SHELL (RIDES) USE IN THE COLLEGIATE ENVIRONMENT

Patrick R. Mattson
Assistant Professor
Department of Technology - Aviation
St. Cloud State University

Abstract

The practical use of interactive computerized instructional authoring tools by post secondary teachers holds exciting promise for the enhancement of the educational process. However, before this is a reality, a suitable, powerful authoring shell must be made available to allow the instructor to work without a computer programmer. The Rapid Intelligent Tutoring System (ITS) Development Shell (RIDES) (Munro, 1995) holds such promise of being that tool. RIDES, a product of R&D, is a new computer-based training (CBT) authoring shell tool; at this point it is a prototype tool for the production and delivery of learner interactive training through a simulation-based environment on a 80486 or higher class computer running under the UNIX operating system. This research investigated the RIDES authoring shell as to its value, ease of use and the time and effort required in constructing a moderately complex, working simulation tutor by a Subject Matter Expert (SME) in the Air Traffic Control Training (ATCT) domain. Future study should be conducted comparing several commercial CBT authoring packages with RIDES to test the pedagogical effectiveness of the ATCT Basic Tutor, gather baseline data against traditional instruction in an actual academic setting, and validate the effectiveness of RIDES by an SME, i.e. the college teacher and its related benefits.

REPETITIVE SEQUENCE BASED PCR (REP-PCR): AN EPIDEMIOLOGICAL STUDY OF A *STREPTOCOCCUS PNEUMONIAE* OUTBREAK IN PENNSYLVANIA

Sandra L. McAlister
Associate Professor
Department of Biology
Stonehill College
North Easton, Ma. 02357

ABSTRACT

Rep-PCR is used as an epidemiological tool in this blind study of a potential outbreak of *Streptococcus pneumoniae* from Pennsylvania. BOXA1R primer was attached to repetitive, interspersed, non-coding elements of pneumococcal DNA. Areas of DNA between the successive primers were amplified by PCR, and amplicon was separated into distinct bands of DNA by agarose gel electrophoresis. Each sample of pneumococcus was fingerprinted and compared, both by visual and computerized methods, to yield a strain specific identity for each class of organism provided. The BOXA1R Rep-PCR method herein is proposed as a rapid, sensitive, cost-effective procedure ideal for use in epidemiological studies of suspected pneumococcal outbreaks.

MOTION-BASED AUTOMATIC TARGET DETECTION, TRACKING, AND RECOGNITION

Rajiv Mehrotra
Associate Professor
Department of Mathematics and Computer Science
University of Missouri-St. Louis

Abstract

Motion is an important cue used by several biological vision systems for object recognition and scene analysis. Static image feature-based machine vision systems for target detection and recognition usually fail in case of camouflaging, certain climatic and scene illumination that yield poor contrast images, and for certain types of images such as IR images. In such cases, techniques that utilize motion-based techniques are expected to yield better performance. Several experimental studies in vision psychology have demonstrated human visual system's capability to recognition/classification object based on the motion trajectory of a selected set of feature points. It is evident from these studies that moving point trajectories carry object shape related information. This project is concerned with the study of issues pertinent to motion trajectory-based automatic target detection, tracking, and recognition with an objective of developing founding technologies. This research was initiated as part of my Summer AFOSR Faculty Research Associateship at Wright Laboratory. The findings of my initial study of important technical issues, current accomplishments, and proposed future research are described in this report.

SYNTHESIS OF PRECURSORS TO ENERGETIC CATIONS

G. David Mendenhall
Professor
Department of Chemistry

Michigan Technological University

Abstract

A number of promising intermediates for the synthesis of energetic cations have been synthesized from procedures in the literature or modifications of them, including nitroform and its salts, dichlorodinitromethane, silver azide, and others. A novel potential intermediate, nitrosotrinitromethane, appeared to decompose at 0^oC to give nitric oxide, carbon dioxide, and other gases. Tetra-n-butylammonium azide was shown to be a promising reagent for extremely fast nucleophilic introduction of the azide group.

Theory of the Equatorial Spread F: Linear and Nonlinear Dynamics and Wavepackets

Stefano Migliuolo
Research Physicist
Research Laboratory of Electronics
Massachusetts Institute of Technology

Abstract

The linear stability and eventual nonlinear saturation of plasma depletions in the high altitude ionosphere, the F-layer, are modelled via two–fluid equations for a plasma consisting of electrons and a single species of ions. Major emphasis is given to the non–local properties of the perturbations, permitting the description of relatively long wavelength modes ($k_{\perp}L \sim 1$, where L is the plasma density gradient scale length and $k_{\perp}$ the wavevector perpendicular to the magnetic field), a regime not accessible under the often used "local approximation". In examining the linear theory, attention is given to effects due to parallel dynamics, that can give a strong stabilizing contribution for disturbances with perpendicular wavelengths longer than 1 km (i.e., where the power spectrum of Spread F is maximum). The condition for onset (marginal stability) is derived analytically for the ionosphere, including a height–dependent recombination rate. The variation of the eigenfunction with height is addressed using two model equilibria: an exponentially stratified atmosphere and one with local maxima in the density gradient. A nonlinear model, comprising both quasilinear and three–wave coupling, is used to illustrate the dynamics of the depletions and estimates for the saturated amplitudes are given.

A REVIEW OF ELASTOMERIC SYSTEMS MADE CONDUCTIVE THROUGH THE USE OF CONDUCTIVE PARTICLES

Douglas J. Miller, PhD
Associate Professor of Chemistry
Science & Mathematics Department
Cedarville College

ABSTRACT

The literature since 1970 relating to conductive, elastomeric systems filled with carbon or metallic based particles was reviewed. Carbon based particles were normally carbon blacks, sometimes carbon fibers. Both traditional organic polymers and silicone polymers were used in these systems. The properties and use of conductive carbon blacks and metallic particles were discussed. The conductive behavior and the effects of strain or flexing on conductivity were briefly covered.

A SYSTEMS STUDY OF THE SCALABLE COHERENT INTERFACE (SCI)

Sarit Mukherjee
Assistant Professor
Department of Computer Science & Engineering
University of Nebraska-Lincoln

Abstract

The SCI is a new high-speed multiprocessor interconnection standard that delivers GBytes/sec transmission rate along unidirectional point-to-point links connected into a ring topology. Because of the cost and performance potential offered by SCI, the Joint Advanced Strike Technology (JAST) program has selected SCI and its unspecified derivative SCI Real-Time (SCI/RT), as the baseline architecture to address the needs of military aircraft in the post-2005 time frame. The performance of SCI in supporting different classes of applications has not been studied extensively. A need was felt to test different avionics applications on SCI before the actual chip-set is manufactured. The use of extensive simulation of the SCI protocol and evaluation of its performance, when subjected to avionics applications is the means towards this end. This report outlines the work conducted on SCI at the Wright Laboratory during the summer of 1995. As a part of the Summer Faculty Research Program of the Air Force Office of Scientific Research (AFOSR), the author designed and implemented a simulator for the SCI ring at the Wright Laboratory at the Wright Patterson Air Force Base. The kernel of the simulator is the basic SCI transaction model. The simulator, built on the kernel using C programming language in an Unix environment, has the capability of supporting many of the SCI features and interconnection topologies. This report describes the work conducted and the feasibility study of SCI.

A preliminary report of the Bioacoustic and Biocommunication Division (Armstrong Laboratory) HRTF system and its comparison with free field listening conditions

Alan D. Musicant
Assistant Professor
Dept. of Psychology
Middle Tennessee State University

Abstract

A methodology for recording and playback of Head Related Transfer Functions (HRTFs) was established for use with the apparatus developed by the Bioacoustics and Biocommunications Division of the Armstrong Laboratory at Wright Patterson Air Force Base (AL/CFBA). The process involved the introduction and testing of a new microphone recording system, a paradigm for negating the effects of listening over headphones and an experimental design for testing the efficacy of the recorded HRTFs. Additionally, an extended frequency range for the sound stimuli was introduced.

Surface Resistance of High Temperature Superconductor Films Using Dielectric Resonator Measurements

Krishna Naishadham
Associate Professor
Department of Electrical Engineering
Wright State University
Dayton, OH 45435

Abstract

High temperature superconducting (HTS) materials are finding several applications in microwave circuits and devices. It has therefore become necessary and important that microwave characterization of HTS films be performed in WL/MLPO. This research explores the use of dielectric resonators to measure the surface resistance of HTS thin films at microwave frequencies. HTS dielectric resonators, besides offering a method of microwave characterization, are potentially useful as components in microwave systems (*e.g.*, as high-Q filters). We have measured the scattering (S) parameters of loop-coupled cylindrical dielectric resonators containing conductor films, as a function of temperature between 19 GHz and 40 GHz, using an automated network analyzer. By appealing to microwave circuit theory, an efficient algorithm has been developed to extract the surface resistance of the film from the measured S-parameters. The algorithm has been implemented on a 486-PC, and validated for copper films with independent measurements. Potential usefulness of the algorithm to characterize HTS films is discussed.

Timothy S. Newman

Abstract

This report discusses a framework for visualization in imagery exploitation applications. We evaluate a recently-developed tool (called VIA (Visualization for Image Analysts)) whose goal was to aid image analysts through the use of visualization techniques. The strengths and shortcomings of VIA are discussed and suggestions for improvements and new directions for this tool are made. More generically, we also propose a re-casting of the usage of visualization techniques within the imagery exploitation arena, especially for battle damage assessment (BDA), mission rehearsal, and training regimens for image analysts. We also present our new framework for an improved graphical user interface (GUI) for the VIA tool. The new framework conforms to current directions and preferred practices in graphical user interface design.

1 Introduction

Visualization involves the use of computer-synthesized images or pictures to discover or highlight data geometry and topology (that is, the relationships between the data) [2, 9]. Visualization also often involves the hi-resolution animation of time-varying data; in fact, the original understanding and definition of visualization (from a 1987 National Science Foundation Report) considered this to be the hallmark of visualization [8]. Today, visualization also often involves the use of cross-disciplinary techniques, specifically the use of sophisticated scientific tools from other disciplines [9]. Topics of current investigation within the visualization communities include extraction and display of useful features from large datasets; using imaging representations and interactive graphics in manipulation and rendering, including volumetric modeling and rendering, such as viewing the interior of volumes; studying human perception of information; multi-media presentation of information, the portrayal of error and uncertainty in data; and "augmented reality" (also called virtual reality).

In this final report of our 1995 Summer Faculty Research Program experience, we present our work on the development of a framework for the usage of visualization techniques in imagery exploitation applications, particularly in image analysis. In Section 2 of the report, background material on the usage of visualization techniques for cartographic and image exploitation purposes is presented. In Section 3, we evaluate the (Grumman-developed) Visualization for Image Analysts (VIA) tool's aims and goals and the capability of the tool to meet those goals. The fourth section of the report discusses the framework that we are developing to improve the user interface (UI) of the VIA tool and presents our progress to date on this effort. We conclude the report with a discussion of potential future directions for visualization in the imagery exploitation arena.

An addendum to the report briefly discusses a second area of investigation for our summer study, the dual-use Statistical Multiple Object Detection and Location System (S-MODALS) artificial neural network (ANN) technology. In the addendum, we discuss our attempts to integrate the technology into the IE2000 environment.

PREPARATION AND CHARACTERIZATION OF BLENDS OF POLY(METHYL METHACRYLATE) WITH NOVEL SILSESQUIOXANE MATERIALS

Charles J. Noel
Associate Professor
Department of Consumer and Textile Sciences
The Ohio State University

ABSTRACT

Polyhedral oligomeric silsesquioxane (POSS) materials are an important class of compounds having an oxygen/silicon ratio of 1.5, a value intermediate between that found in silicones and silica. An entirely new class of polymerizable monomers containing POSS entities is currently under development at Phillips Laboratory. Incorporation of POSS entities into conventional organic polymers shows promise of enhancing certain properties of these polymers, particularly thermal properties, and may extend the useful temperature range of these materials, and alter their flammability characteristics. In this study, the extensively used thermoplastic poly(methyl methacrylate) (PMMA) was blended with two different POSS compounds, one a POSS macromer, 3-T_8Cy_7propyl methacrylate, and the other a copolymer of methyl methacrylate with the same POSS macromer. Blends were prepared by dissolving the materials to be blended in a common solvent, thoroughly mixing the solution, and recovering the solid blend by evaporating the solvent. Procedures were developed for removing virtually all solvent from the blends, and for processing the blended materials into useable forms for further extensive characterization. Blends were characterized using conventional thermal analytical techniques, including Differential Scanning Calorimetry (DSC), Thermogravimetric Analysis (TGA), and Thermomechanical Analysis (TMA). Incorporating the POSS entity into a copolymer with methyl methacrylate greatly increases the amount of POSS which can be blended with PMMA. Clear films were obtained at the 50/50 w/w blend level; these blends contain 35% POSS by weight. When the homopolymer of the same POSS macromer was blended with PMMA, clear films could only be obtained with a POSS loading of 9% or less.

CALIBRATION OF INFRARED THERMOGRAMS OF ELECTROMAGNETIC FIELDS

John D. Norgard
Professor/ECE
Department of Electrical & Computer Engineering
University of Colorado

Abstract

The infrared (IR) imaging technique for measuring electromagnetic (EM) fields was further developed this summer to map two-dimensional EM field distributions near a radiator or a scattering body. Both electric and magnetic field intensities have been measured with this technique. Initial tests to prove the validity, accuracy and sensitivity of this technique were performed this summer in the anechoic chamber at the Electromagnetic Vulnerability Analysis Facility (EMVAF) at Rome Laboratory (RL). Empirical calibration tests were performed to determine the absolute intensity level of the magnitude of the electric field. Magnetic field intensity levels were not calibrated this summer.

Experimental tests were performed on a conducting cylinder irradiated by an incident plane wave. E- and H- field patterns of the scattered/diffracted energy from the cylinder where measured. Tests were conducted at various microwave frequencies relative to the resonant frequencies associated with the cylinder and at numerous angles of incident (eg. end-on, broad-side, oblique-incidence) and for several different polarizations of the incident field relative to the axis of the cylinder (eg. horizontal, vertical, and skewed). Each tests was performed in the near and far fields of the cylinder. IR thermograms of the scattered fields were taken. The equi-temperature contour levels in the IR thermograms are being compared to numerical predictions of the scattered electric field intensity. The numerical code was developed at the Jet Propulsion Laboratory (JPL). These experimental results will be used to validate the accuracy of the JPL numerical code.

The imaging technique was also used to map the scattered electric field around a model of an aircraft. A plastic F16 scale model was constructed and sprayed with several coats of silver paint to made it conductive. IR thermograms of the magnitude of the scattered electric field intensity were taken in the horizontal and vertical longitudinal planes through the fuselage of the aircraft. The equi-temperature contour levels in the IR thermograms are being compared to numerical predictions of the scattered electric field intensity. The numerical predictions are being performed with the GEMACS code at Rome Laboratory. These experimental results will be used to validate the accuracy of the GEMACS numerical code.

The lossy IR detector screen was irradiated by a normally incident EM wave in the near and far fields of the antenna. The level of the incident electric field was measured using D-dot probes and was

also predicted theoretically using the Friis Transmission/Reception Formula. The known field radiated from the standard gain horn antenna was used to calibrate the measured temperature levels in the IR detector screen. A correlation of the measured temperature level (a selected color on the IR thermogram) to the measured or predicted magnitude of the incident electric field was used to calibrate the IR technique. A table of color level vs. incident field level was made. This table is the calibration curve for the IR detector screen used in the calibration test. Different IR detector screens with different sensitivities can all be calibrated using this same technique.

Four papers were presented at international IR and EM conferences this summer; two seminars were also presented on the technique. One paper was published in an IR journal; three new papers have been submitted for presentation at several IR conferences next year.

SECONDARY ELECTRON EMISSION AT PLASMA-FACING SURFACES

Carlos A. Ordonez
Assistant Professor
Department of Physics
University of North Texas

Abstract

The secondary electron emission coefficient is evaluated for electron impact on anode, cathode, and electrically-floating plasma-facing surfaces. Two energy and angle distribution functions for electron impact on a plasma-facing surface are derived and different relations for the secondary electron emission coefficient which functionally depend on energy and angle are integrated over the distributions. One integration is in closed form and provides a parametric expression for the secondary electron emission coefficient of a plasma-facing surface. The other integrations are carried out numerically. Evaluation of the secondary electron emission coefficient for a variety of commonly-used plasma-facing materials shows that its value is near or above unity over a significant range of plasma temperatures.

SET-UP FOR PLASMA INSTABILITY ANALYSIS OF KILOHERTZ ORDER WAVES ASSOCIATED WITH ELECTRON BEAM OPERATIONS ON STS 46

Michael J. Pangia
Assistant Professor
Department of Geology & Physics
Georgia Southwestern College

Abstract

A certain set of electron data measured by the Space Particle Correlator Experiment (SPACE) during beam operations on STS 46 showed wave behavior in the 0.5 to 2 kHZ frequency range. This work derives a tractable equation from the full dispersion equation given in *Kindel and Kennel* [1971] to perform an instability analysis to account for the observations. It assumes that the waves can be explained by the two dominant plasma components, the O^+ ions, and the returning electrons. Further assumptions are that $k_\perp^2 A_e^2 < 2\Omega_e^2$ and that $\Omega_i < k_\parallel A_i$, where A_e and A_i are the electron and ion thermal speeds, and Ω_e and Ω_i are the cyclotron frequencies.

Suggestions for further progress are made in the report.

ANTENNA EFFECTS AND WL/AAAI'S
ANTENNA WAVEFRONT SIMULATOR

Robert P. Penno, Ph.D.
Assistant Professor
Department of Electrical Engineering
University of Dayton

Abstract

A procedure for augmenting the accuracy of the Antenna Wavefront Simulator (AWFS) by improving the model of the antenna array simulated by the AWFS was studied. Use of a wire model of the antenna array accurately characterized the field pattern of the array, but did so with terminal currents not necessarily similar to those of the array under test. Other modeling techniques, such as the Finite Element Method (FEM), may be better suited to characterizing the type of antennas, typically microstrip patch antennas, to be evaluated for the AWFS. The wire model displayed some significant effects due to element mutual impedance. This was especially true of the reference element. The concept of perturbing the AWFS from the omnidirectional case seems valid. Also, use of the Geometrical Theory of Diffraction (GTD) to describe incidence from below horizon should be further investigated.

EXPLORATORY STUDIES OF AN IMAGE MOTION ANALYSIS SYSTEM

Ronald M. Pickett
Professor
Department of Psychology

and

Institute for Visualization and Perception Research
University of Massachusetts Lowell
One University Avenue
Lowell, MA 01854

Abstract

Tests were conducted of a system for analyzing the motion of non-rigid structures in time-lapse images. Tests with well specified artificial images showed that the system operates as intended. Tests with real images of depletion patterns in allsky images of the ionosphere, taken with a fisheye lens, show that when operated in a high-threshold mode the system produces motion data consistent with what would be expected. In a low threshold mode, the system produces reliable findings of motions that would not be expected. In pursuit of an explanation, it was determined that high frequency components of the images contribute little if anything to the motion findings. This would be consistent with the possibility that the aberrant findings are due to optical or geometrical distortions in the allsky image as the pattern moves past the camera, but a final explanation has not been established.

THE EFFECTS OF EXTREME ENVIRONMENTS ON HL-60 PROLIFERATION AND CYTOKINE PRODUCTION

Edward H. Piepmeier, Jr.
Assistant Professor
College of Pharmacy
University of South Carolina

Abstract

The primary goal of this summer's research was to identify how hypobaric and hyperbaric exposure alters the proliferation and cytokine production of leukocytes. In addition, these cells will be tested in the microgravity environment aboard the STS-69 Space Shuttle Flight. HL-60 cells, an immortalized human promyelocytic cell line, were used as a model for this study. While these cells could be expected to exhibit a response different than normal human promyelocytic cells, the variation associated with HL-60 cells is much less. We found that exposure to rapid decompression resulted in a significant increase in cell proliferation, while exposure to a high pressure resulted a proliferation rate lower than but not significantly different than the control cells. Corresponding changes were observed in IL-1, IL-2 and nitrite production. These preliminary results indicate that leukocytes may be a good marker for decompression sickness and hyperbaric oxygenation therapy which is used to treat the disease. Further studies should be conducted to examine the sequential effects of rapid decompression and hyperbaric oxygenation on the cells.

FLEXIBLE ADJUSTMENT OF DATA

Michael A. Pittarelli
Associate Professor
Department of Computer and Information Science
SUNY Institute of Technology at Utica/Rome

Abstract

Databases may exhibit many forms of incompleteness. This report explores methods for overcoming incompleteness in the form of missing tuples. Specifically, algorithms are investigated for replacing a relation that is known to be incomplete with a superset. Of particular interest are algorithms that make available at any time an approximation and with the property that the approximate solution improves monotonically with computing time. How to measure the quality of an approximation depends on the use to which a relation is to be put. Although this report concentrates on rule matching in rule-based systems, application of these and similar methods to problems of knowledge discovery in incomplete databases is also discussed.

TOPICS IN INITIATION AND PROPAGATION OF DETONATION IN REACTIVE SOLIDS

Joseph M. Powers
Associate Professor
Department of Aerospace and Mechanical Engineering
University of Notre Dame

Abstract

Issues in the transient development of detonations in reactive solid materials have been studied. A macroscopic two-phase model was employed to predict the shock-to-detonation (SDT) in a granulated solid explosive. The long time results were shown to be fully resolved and in agreement with independent predictions from steady theory. Additionally, prediction of the transition time to detonation agreed well with other unsteady theories. In a second effort, a simple microscopic model of reactive shear bands was developed in order to focus on the small scale mechanisms of initiation. It is planned to solve these equations and compare results with those obtained in a coupled experimental study employing a torsional Hopkinson bar.

PROCESS CONTROL OF HYBRID OXYGEN SYSTEMS

Randel M. Price
Assistant Professor
Department of Chemical Engineering
University of Mississippi

Abstract

Hybrid oxygen systems were reviewed to identify feasible improvements in the process control system. Suggested improvements should reduce the average rate of consumption of refrigerant air.

This reduction should, in turn, reduce the operating cost of the systems. Other recommendations should improve the flexibility and reliability of the systems and increase the value of the information gathered from the proof-of-concept unit.

A C++ TEST BED FOR GRAPH PARTITIONING AND MAPPING FOR PARALLEL PROGRAMMING

Mark Purtill
Assistant Professor
Department of Mathematics
Texas A&M University–Kingsville

Abstract

Many problems in computational physics can be viewed as computations carried out on graphs (networks); one such problem arises in particle-in-cell (PIC) plasma simulations. As many multiprocessors (massively parallel computers) can also be viewed as graphs, the problem of partitioning such problems to run efficiently on a multiprocessor is a graph theoretic problem. It can be viewed as choosing a graph map between the two graphs minimizing a function.

Unfortunately, this problem is NP-complete, which means it is very unlikely that we can find an efficient, exact algorithm. Therefore, we must rely on heuristic methods. Many such methods have been proposed for this and related problems.

To investigate which of these algorithms are best suited for the graphs arising from PIC simulations, we have developed a test bed program which runs on both networks of workstations and on multiprocessors. The test bed is written in C++, using modern programming methods such as object-oriented design and literate programming.

A STUDY OF THE NEW NEAR-OPTIMAL NONLINEAR CONTROL DESIGN TECHNIQUE

STATE DEPENDENT ALGEBRAIC RICCATI EQUATION (SDARE) METHOD

Zhihua Qu

Associate Professor

Department of Electrical and Computer Engineering

University of Central Florida

Orlando, FL 32816, USA

Abstract

In this report, global stability of a nonlinear regulator design is studied. The technique under investigation is the state-dependent algebraic Riccati equation technique recently proposed in [4, 5]. A near optimal strategy is proposed under which global asymptotic stability of nonlinear system is guaranteed under point-wise stabilizability of its linearized version and two-point boundary value problem is avoided. The study is done using Lyapunov direct method and is based on judicious choices of weighting matrices Q and R. Although the resulting control is only near optimal, the proposed control design method is not only efficient in implementation but also applicable to general nonlinear systems with guaranteed stability and performance.

PROCESS MODELING AND EXPERIMENTAL STUDIES OF THE DENSIFICATION OF POWDER COMPACTS

M. N. Rahaman
Professor
Department of Ceramic Engineering
University of Missouri-Rolla

Abstract

Mechanistic and continuum models for the densification of powder compacts under a complex stress system were reviewed. The key features of the models were examined and their predictions for the effect of porosity on the densification rate were compared. Experimental studies of the sintering of mullite core particles coated with a layer of amorphous mullite were performed. The coated particles (in the form of a concentrated suspension) can potentially be used in the infiltration of fiber preforms for the production of porous matrix composites. Compared to uncoated mullite particles, the higher sinterability of the coating is expected to lead to a reduction in the fabrication temperature of the composite.

A STUDY OF IMPEDANCE MATCHING OF MICROSTRIP PATCH ANTENNA ARRAYS OVER WIDE SCAN ANGLES

Sembiam R. Rengarajan
Professor
Department of Electrical and Computer Engineering
California State University
Northridge, CA 91330-8346

Abstract

The concept of impedance matching of an infinite phased-array antenna over wide scan angles by means of a coupling circuit in the feed network was originally proposed by Hannan et al. To the best of our knowledge this concept was not implemented in practice. We investigated the feasibility of implementing this technique for microstrip patch arrays. Computed values of input impedance as a function of scan angles in E-plane, H-plane, and D-plane (45°) were used as input to an optimization program, which minimized the reflection coefficient magnitude over a range of scan angles. The output of the program are the line lengths and coupling susceptances in the E-plane and in H-plane. We designed coupling networks for matching three microstrip patch array geometries over wide scan angles. Preliminary studies show that it is possible to realize such coupling networks in microstrip-type transmission medium.

ABSTRACT

Psychological issues in pilot training completion and retention.

Paul D. Retzlaff
Associate Professor
Department of Psychology
University of Northern Colorado

A number of studies have examined the intelligence and personality of pilots. Few, however, have been able to utilize long-term follow-up data. Three-hundred and fifty Air Force officers undergoing Undergraduate Pilot Training were administered the Multidimensional Aptitude Battery, the Personality Research Form, and the Millon Clinical Multiaxial Inventory. Ten year follow-up data is provided on pilot training completion and length of service. No differences were found among the training completions groups but a number of consistent personality variables were correlated with length of service.

VERTICAL-CAVITY SURFACE-EMITTING LASERS FOR "SMART PIXEL" ARRAYS AND OPTOELECTRONIC INTERCONNECTS

Dean Richardson
Assistant Professor and Photonics Program Coordinator
Department of Electrical Engineering Technology
State University of New York Institute of Technology at Utica/Rome

Abstract

Vertical-Cavity Surface Emitting Lasers (VCSELs) for "Smart Pixels" and optoelectronic interconnects have been studied under the RDL Summer Faculty Research Program. The objective was to provide reliable and robust processing recipes through iterative fabrication/characterization cycles. A working 4x4 VCSEL array has been demonstrated.

E-MORPH: A SYSTEM FOR EVOLVING STRUCTURAL FEATURE DETECTORS FOR AUTOMATIC TARGET RECOGNITION

Mateen M. Rizki
Associate Professor
Department of Computer Science and Engineering
Wright State University

Abstract

E-MORPH is multi-phase evolutionary learning system that evolves cooperative sets of features detectors and combines their response using a simple discriminant function to form a complete pattern recognition system. The learning system operates on multi-resolution images that are formed by applying a Gabor wavelet transform to a set of grayscale input images. To begin, candidate target/nontarget chips are extracted from the multi-resolution images to form a training set and a test set. A population of detector sets is randomly initialized to start the evolutionary process. Using a combination of evolutionary programming and genetic algorithms, the feature detectors are enhanced to solve a specific recognition problem. This report describes the implementation of E-MORPH and presents recognition results for a complex problem in medical image analysis. The specific recognition task involves the identification of vertebrae in x-ray images of human spinal columns. This problem is extremely challenging because the individual vertebra exhibit variation in shape, scale, orientation, and contrast. E-MORPH generated several accurate recognition systems to solve this task. The techniques used in E-MORPH are generic and can be readily transitioned to many different problem domains.

A STUDY OF THE EFFICIENCY OF THE CODING STRUCTURES IN THE CFD CODE XAIR

Robert L. Roach
Assistant Professor
Mechanical and Aerospace Engineering

Abstract

The work reported here is concerned with some of the basic programming structures in the comprehensive CFD code XAIR. The code makes use of subroutines which solve block tridiagonal systems. These subroutines and the ones which load the associated arrays typically consume 70-75% of the CPU run time. Since the algorithms for these subroutines were devised some time ago, it was deemed useful to enquire as to whether changes in computer architecture over the years warranted a review of the actual coding. It was found two of the block solvers suffer from severe "striding" problems on work stations. An alternative set of block solvers was examined for speed of computation since little comparison information has been reported in the literature. The existing block solvers were the fastest on large scale computers but were the slowest on work stations due to the striding problem. However, a modification was found which produced an execution time reduction of a factor of 10. Unfortunately, large portions of the code would be required to be changed. An alternative was found for the two block solvers which still reduced the time of computation (factor of 4) and which was also transparent to the rest of the code. Subsequent testing on a realistic, multiple grid problem revealed a 21% reduction in run time with the modified routines. The work predicts an overall reduction in run time of about a factor of two if the proposed index rearrangement were to be implemented.

COMPUTER-AIDED FIXTURE CONFIGURATION DESIGN USING ADAPTIVE MODELING LANGUAGE (AML)

Yiming (Kevin) Rong
Assistant Professor
Manufacturing Systems Program
Southern Illinois University at Carbondale

Abstract

Flexible fixturing is an important aspect of flexible manufacturing systems (FMS) and computer-integrated manufacturing systems (CIMS). Modular fixtures are the most widely used flexible fixtures in industry for job and batch productions. Computer-aided fixture design (CAFD) has become a research focus in implementing FMS and CIMS. Fixture configuration design is an important issue in the domain of CAFD. A review of the current research in CAFD indicates that one major problem impeding the automated fixture configuration design (AFCD) is the negligence of study on fixture structures. This research investigates fundamental structures of dowel-pin based modular fixtures and fixturing characteristics of commonly used modular fixture elements. A modular fixture element assembly relationship graph (MFEARG) is designed to represent combination relationships between fixture elements. Based on MFEARG, an adaptive modeling language (AML) which is applying the objective-oriented programming technique is used to develop the AFCD system, including the core modules of fixture unit generation with alternatives and fixture unit placement into appropriate positions on a baseplate. A prototype system for AFCD with dowel-pin modular fixtures is presented in this report.

ADA-SDP: AN ADVANCED AVIONICS SOFTWARE-DEVELOPMENT PROTOTYPE

Stuart H. Rubin
Assistant Professor
Department of Computer Science
Central Michigan University

Abstract

The goal, of this on-going project, is to provide avionics systems designers with a tool (i.e., the Avionics Designer's Associate, or simply ADA), which assists software engineers in the rapid prototyping and testing of system models. A system model contains details of the planned system, but only to a level deemed adequate for integration testing.

Models are executable prototypes. Modeling is closely tied to simulation, which refers to the exercise of a model over a variable parametric space. Model simulations not only provide the engineer with feedback pertaining to the validity of a proposed design, but additionally allow competing designs to be compared on one or more parameters (i.e., sensitivity analysis).

Models are defined from a base of several hundred primitive constructs. These constructs can define additional constructs hierarchically. All constructs (i.e., including their block names, icons, descriptive text, multimedia files, etc.) are placed in library folders in accordance with their operational domain.

This past summer, an expert^n--system was constructed, which retrieved software for reuse. This expert system is itself reusable and consists of many sub-systems -- any one of which can invoke any other. A key feature is that any expert^n--system need never be modified, for purposes of reuse, once saved in a repository. Rather, it communicates all information back to the caller and lets the caller decide how and when to use it. Thus, blocks in an expert^n--system have very low coupling (i.e., no off-model connections). In addition, expert^n--systems are, as their name suggests, organized in a hierarchy. This means that very complex decision-making systems can be called into play with minimal effort. Growing the repository is equivalent to learning. A two-hour video tape was delivered to Wright Laboratory, which depicts the use of the expert^n--system in retrieving software based on ambiguous specifications.

USING LASER DYNAMICS TO PROBE INTRACAVITY COLLISIONAL RELAXATIONS

Jeff Nicholson
Graduate Student
Wolfgang Rudolph
Associate Professor
Department of Physics and Astronomy
The University of New Mexico
Albuquerque, NM 87131

Abstract

The pulse parameters of a photolytic, gain-switched iodine laser are measured for different pressures of active gas and for various buffer gases. A rate equation model of the laser dynamics is fit to experimental data, to obtain information about collision-controlled relaxation processes of atomic iodine.

ANALYSIS OF LOADS ON THE NECK AND HEAD JOINTS DUE TO G-Y ACCELERATION

Ali M. Sadegh
Professor and Chairman
Department of Mechanical Engineering
The City College of The City University of New York

Abstract

During an emergency ejection from aircraft, pilots are subjected to a high acceleration that could causes injuries. These injuries, particularly at the neck region, are exacerbate with the additional weight that is added to the head gear of the pilot such as night vision goggles and helmet-mount displays. There have been some studies on the head acceleration in the Z and X direction. The objectives of this study were a: to employ DYNAMAN and or ATB to validate the test results for the G-y acceleration, and b: to determine the loads and the torques at the neck-head and neck-upper torso joints. The experimental data were collected from the biodynamics responses of human volunteers during an acceleration in the Y direction of a sled at the sled track facility at Armstrong Laboratory at WPAFB. The sled was subjected to 4G to 7G and duration ranging from 31ms to 250ms in a total of 9 cells. Three segments model consists of head, neck and upper torso was employed. The experiment was validated by selecting the spring and the dashpot parameters of the ATB model so that the test results reasonably match with the experimental results. Using these parameters, the loads and the torques at the neck- pin and the head-pin joints were determined. Plots of the maximum loads and torques versus the amplitude and the duration of the acceleration of the sled were presented. Further analysis is needed to assess the cause of neck injuries and evaluation of human tolerance levels.

STEREOGRAPHIC IMAGING OF IRREGULARITIES ASSOCIATED WITH HEATED REGIONS IN THE IONOSPHERE

Gary S. Sales and Arjang Noushin

Center for Atmospheric Research
University of Massachusetts Lowell
Lowell, MA.
USA

Abstract

The goal of this investigation is to demonstrate a technique for three dimensional imaging of irregular electron density structures in the F-region of the ionosphere, such as polar patches, high power HF ionospheric modification regions and equatorial depletion bands. Through the use of multiple HF sounders, each capable of locating ionospheric irregularities or sources using the standard Digisonde Doppler interferometry technique, it is demonstrated that the array of sounders all "view" the same irregular regions of the ionosphere and in the process measure the velocity components in the direction of each sounder. Combining these data from many sources leads to a model of the velocity distribution within the disturbed region.

A FLEXIBLE ARCHITECTURE FOR COMMUNICATION SYSTEMS (FACS): SOFTWARE AM RADIO

John L. Schmalzel
Professor of Electrical Engineering
School of Engineering
Rowan College of New Jersey

Abstract

Interest in *software radio* is driven by the search for universal communication system architectures consisting of minimum radio frequency (rf) front-end hardware, which perform as much radio functionality as possible in software. An investigation into flexible software radio architectures for amplitude modulated (AM) broadcast spectrum (540-1680 kHz) signals was conducted. Using a variety of commercial data acquisition platforms and personal computer based software, the requirements for an AM software radio have been defined and are described, allowing the further development of a FACS platform for testing software radio concepts.

The elements of the AM software radio include: (i) A front-end with gain to raise detected signals to a magnitude within the conversion range of the analog-to-digital (A/D) converter, and an anti-aliasing low-pass filter (LPF). A nominal 1 μV rf signal requires a gain of 1E06 (60 dB) to provide a 1 V magnitude compatible with many high-speed A/D converters. (ii) An A/D converter chosen to sample at a rate sufficiently higher than the bandwidth of the AM broadcast band to avoid aliases and to allow the use of a low-order LPF. (iii) A digital signal processor (DSP) or other general purpose computer to perform tuning using a bandpass filter (BPF) and demodulation with a lossy peak detector. (iv) Final audio output formatted as a *.wav* file for compatibility with standard multimedia sound (*Soundblaster*) cards.

THE ROLE OF SULFUR COMPOUNDS IN FUELS ON THE FORMATION OF ENGINE DEPOSITS

William D. Schulz
Professor
Department of Chemistry
Eastern Kentucky University

Abstract

The effect of organo-sulfur containing compounds on deposit formation by thermally stressed fuels was studies. Thiols and thiophenols were found to greatly increase the formation of solid, insoluble deposits. Sulfides, disulfides and thiophenes were fount to have little effect on the formation of deposits. Fuels were thermally stressed in air. Polar oxidation products were extracted and analyzed. Deposits were analyzed by sequential thermal desorbtion pyrolysis in a gas chromatograph-mass spectrometer. A hydrotreated, thermally stable fuel that does not produce insoluble deposits when thermally stressed, did produce insoluble deposits when doped with 300 ppm of thiophenol.

These deposits were completely unlike deposits from the undoped fuel in that they were highly phenolic. Undoped fuel does not form insoluble deposits and the gums formed by such fuels contain aliphatic alcohols and carbonyl compounds. The results of the study emphasize a dichotomy of mechanisms in deposit formation. A mechanism of arylhydroperoxide formation, decomposition to phenols and oxidative phenolic coupling as the route of deposit formation by straight-run fuels containing significant amounts of sulfur and substituted aromatic compound is strongly suggested.

HALF-LIFE STUDIES IN RANCH HAND VETERANS

Kandasamy Selvavel
Associate Professor
Department of Mathematics and Computer Science
Claflin College

Abstract

Half-life of 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) in veterans of Operation Rand Hand was studied using measurements from serum collected in 1982, 1987 and 1992. In our study we estimated the half-life using two measurements per subject and three measurements per subject. These half-lives were corrected by finding the regression effect towards the mean. Then the bias, variance and mean square error (MSE) of the estimators were computed and compared for various cases. It was noticed that for large sample unbiased estimators were admissible when we took two measurements per subject. In general this result doesn't hold for small sample study. Further more, we studied the mean square error as a function of truncation point. We fixed the second truncation point and moved the first one towards the second one. It is observed that the difference in mean square errors between unbiased and biased estimators changes sign. That is, when the truncation points are closed to each other unbiased estimator has a smaller mean square error than that of biased estimator. On the other hand when the first truncation point moved away from the second point, mean square error of the biased estimator was getting bigger than that of the unbiased estimator.

Chlorine Disinfection of Dental Unit Water Lines

Larry R. Sherman, Department of Chemistry, University of Scranton, Scranton PA 18510-4626

ABSTRACT

Potentially pathogenic microorganisms may participate in the formation of microbial biofilms on the interior walls of the plastic tubing used to supply coolant and irrigating water in dental units. Conscientious treatment procedures appear to be necessary to control the growth of dental unit waterline biofilms. There is little scientific basis for currently recommended treatment protocols for treatment and maintenance of dental water delivery systems. The summer research program was designed to test the effect of diluted commercial bleach (5.25% sodium hypochlorite) on biofilm colonizing dental unit water lines. A baseline bacteriological assay was performed on 24 dental units located at 4 separate USAF dental clinics located in the same metropolitan area. Twelve units at 3 clinics (designated Clinics I, II, and III) had been treated once weekly with 1:10 NaOCl for periods ranging from 6 months to 6 years. Twelve units at Clinic IV were selected for a 28 day study of the effectiveness of 2 dilutions (1:10, 1:100) of 5.25% sodium hypochlorite for control of biofilm growth in dental water lines. Eight units were treated weekly with either 1:10 or 1:100 solutions of commercial bleach. The 4 controls were treated only with sterile distilled water.

The units at Dental Clinics I and II had relatively low levels of colony forming units/mL (CFU/mL) ranging from 0 to 8.8×10^3 CFU/mL with a mean of 2.2×10^3 CFU/mL. The chlorine profile curves produced a distinct chlorine concentration (ppm) versus a cumulative volume profile. The chlorine concentration showed very little initial change, then rapidly fell to zero as the solutions were flushed from the units with distilled water. The total chlorine mass recovered at these clinics varied from 94-101.7% with the average being approximately 98%. Assays of planktonic bacteria at Clinics III and IV were much higher (Clinic III Range: 1×10^2 CFU/mL to 4.8×10^5 CFU/mL, Mean: 1.8×10^5 CFU/mL; Clinic IV Range: 5.6×10^4 CFU/mL to 1.1×10^6 CFU/mL, Mean: 4.7×10^5 CFU/mL) suggesting higher levels of biofilm contamination. The chlorine recovered from Clinics III and IV varied from 40-88% with the average being approximately 80%. The chlorine profile curves for the units at Clinics III and IV initially fell very rapidly, then more slowly throughout the profile study period. The difference in the profile curves may be due to absorption and reaction of the available chlorine by adherent biofilms. Subsequent assays of planktonic bacteria support this hypothesis.

At the conclusion of the 28 day treatment of Clinic IV units, the average chlorine recovery was 99.7% and the profile for a 1:10 sodium hypochlorite treatment yielded curves with the same characteristics as those at Clinics I and II, suggesting low levels of microbial contamination. Although each subsequent treatment of units with 1:100 NaOCl solution consumed less chlorine than the previous treatment, planktonic bacteria were still recovered at the end of the 28 day study (Range: 30 CFU/mL to 5×10^6 CFU/mL, Mean: 1.3×10^6). A plot of the percent chlorine recovered versus the log of the CFU yields inverse linear relationships. When linear regression of all samples (n=52) is performed using the percentage of active chlorine recovered versus log CFU/mL, an inverse relationship is revealed.

IMAGE EXPLOITATION: WAVELETS RESEARCH AND IMAGERY TOOLKIT DEVELOPMENT

Frank Y. Shih
Associate Professor
Department of Computer and Information Science
New Jersey Institute of Technology

Abstract

The exploitation of digital reconnaissance imagery requires efficient storage, transmission, image processing, browsing, retrieval and analysis of large volumes of image data. An image compression scheme for multiresolution coding by wavelets to alleviate the transmission problem of high resolution images over low speed channels is developed. This scheme has the advantage of progressive transmission such that it can transmit the lowest resolution image to the decoder and the finer details are transmitted progressively. A block variance detector on the lowest subband to predict if the high subbands contain edge information is used to achieve efficient compression. The morphological close-minus-open operation is used for target recognition to eliminate background clutter whose size is larger than the targets. A macro wavelet function with a Gaussian low-pass filter is used to clutter with particle sizes similar to or smaller than the targets. The graphical user interface of an imagery toolkit is developed under X window in SUN Solaris system. It includes the often-used techniques in image processing such as image manipulation, enhancement, feature extraction, filtering, degradation, statistics, segmentation, and morphology.

Spectral Effects on the Signal-To-Noise-Ratio of Short Exposure Photon-Limited Stellar Data

Melani Shoemaker
Instructor
Department of Electrical Engineering
Seattle Pacific University

Abstract

Due to the desire for high resolution images of objects in space, several techniques are undergoing active research to combat the resolution limitations induced by atmospheric turbulence. Among these methods, speckle imaging techniques, initiated by Labeyrie, combine multiple short exposure images to reduce atmospheric effects. One significant measure of the success of this technique is the signal-to-noise ratio (SNR). Traditionally, efforts to increase this important quantity have been based on temporal issues. Our focus, on the other hand, is the investigation of the spectral bandwidth's impact on the SNR. This investigation involves comparison of theoretical expectations with computer simulated data and field data.

MODELING, ANALYSIS, AND DESIGN OF BLADED DISKS FOR ALLEVIATION OF HIGH CYCLE FATIGUE IN GAS TURBINE ENGINES

Joseph C. Slater
Assistant Professor
Department of Mechanical and Materials Engineering

Abstract

This report discusses methods for modeling and analyzing bladed disk assemblies common to gas turbine aircraft. An introduction to symmetric (tuned) bladed disk dynamics is presented. Special attention is paid to a literature review of studies of modeling of bladed disks, modeling of blade mistuning, and the effect of mistuning on mode localization and flutter, with a stronger emphasis being placed on forced excitation. A summary of results is given, and suggestions for future work are made.

Connecting CASE to Simulation Development

Jeffrey W Smith
Associate Professor
Computer Science Department
University of Georgia, Athens, GA

Abstract:

Object-Oriented Computer-Aided Software Engineering (CASE) tools are needed in the process of simulation development. Simulation development is similar to other forms of software development, though there are differences. We have developed an automated connection of Object-Oriented CASE software development tools to simulation development. Specifically, we have evolved an environment in which the Object-Oriented CASE tool ROSE™ is connected to the Object-Oriented simulation development environment MODSIM™. With this connection, we can use the outputs from the CASE tool to define classes, objects, and relationships and to suggest the modularity of the simulation system. We can provide (stubs of) code from the CASE tool to directly aid coding in the simulation development environment.

Ideally, the connection runs both ways, producing code from CASE files and CASE files from code. This bidirectionality keeps the implementation and documentation of the class and object structures in step, we have made some progress towards this Round Trip connection.

Application of ATM Networks in Distributed Systems

Scott Spetka
Assistant Professor
Department of Computer Science
State University of New York
Institute of Technology at Utica/Rome

Abstract

Every time an order of magnitude improvement occurs in hardware speed, it requires a qualitative reexamination of system design and software architecture. Every major advance in hardware has left software engineers and system designers looking for operating system structures to harness new capabilities and applications that are in need of increased performance. High-Bandwidth ATM Networks are no different than other major advances in this respect. This study examines low level system support for ATM networks. In addition, experimental measurements show that harnessing the potential of ATM in existing applications requires appropriate low-level system support. Two applications are used as examples where the benefits of ATM can be immediately applied.

THE PROPER SEQUENCE FOR CORRECTING CORRELATION COEFFICIENTS FOR RANGE RESTRICTION AND UNRELIABILITY

Joseph M. Stauffer
Department of Management & Finance
Indiana State University

Abstract

Many researchers are unaware that the derivation for the formulas widely used in corrections for range restriction in correlation coefficients assume the absence of measurement error. Using the case where both restricted and unrestricted standard deviations are known for the variable upon which selection is made, it is shown that in order to apply the traditional range restriction correction formula correctly, the restricted correlation coefficient must first be corrected for unreliability in both variables. Additionally, the ratio of restricted to unrestricted standard deviations used in the correction must first be corrected for unreliability. Then, and only then, should the traditional formula be used. Similar results hold for other forms of range restriction. Implications for psychometric meta-analysis are briefly discussed.

Pharmacological Intervention to Increase the Time before Gravity Induced Loss of Consciousness in Rats and Mice

William B. Stavinoha, PhD
Professor in Pharmacology
Department of Pharmacology

Abstract

Research on the modification of +Gz induced loss of consciousness in rats and mice focused on the effect of +Gz on regional brain neurochemistry and the testing of cholinergic agents and an adenosine receptor blocking agent on the time to GLOC. Exposure of mice to +35Gz for 30 seconds produced GLOC. Thirty seconds of +35Gz significantly increased lactate in the cerebral cortex, cerebellum, hippocampus, midbrain and brain stem. It caused no change in acetylcholine but significant increases in choline in all regions. Significant decreases occurred in 5 hydroxytryptamine in cerebellum, brain stem and midbrain. Homovanillic acid increased significantly in the midbrain. Epinephrine decreased significantly in the cerebellum and mid brain. Chronic caffeine ingestion for 8 weeks decreased the dopamine in the cerebellum and brainstem in control mice and in GLOC mice. In the study of GLOC modification one cholinergic agent was effective in extending the time to GLOC in rats. 3,4-diaminopyridine 2,5 pmol/kg ip increased the time to GLOC from control times of 13.5±2.7 to 24.7±7.2 seconds while 5 pmol/kg increased the time to 81.7±15.3 seconds. Caffeine an adenosine A1 receptor blocker at 50mg/kg increased the time to GLOC from 14.5±2.3 seconds to 35±13.2 seconds. These initial studies indicate that it is possible to significantly extend the time to GLOC by pharmacological intervention.

A STUDY OF PULSED LASER DEPOSITION OF SILICON CARBIDE THIN FILMS

Ronald Birkhahn
Graduate Student Associate
Department of Materials Science

Andrew J. Steckl
Professor
Department of Electrical and Computer Engineering

ABSTRACT

We investigated the validity of using pulsed laser deposition (PLD) to deposit single crystal epitaxial SiC films during the Summer Research Program at Wright Patterson Air Force Base. After modification of the substrate stage for heating capability, SiC was pulsed-laser-deposited onto (001) Si, SiC on (111) Si, and SiC substrates. X-ray diffraction (XRD) showed that the crystallinity of the deposited SiC film improved with increasing substrate temperature and reduced laser repetition rate, but remained polycrystalline overall. However, discrepancies between temperature characterization techniques prevented us from accurately determining the substrate temperature.

OPTIMAL WARGAMING SCENARIO GENERATION FOR REAL TIME AUTOMATIC CONTROL OF MANNED AND UNMANNED AERIEL VEHICLES

Boris Stilman
Professor
Department of Computer Science & Engineering
University of Colorado at Denver

Abstract

We consider the application of Linguistic Geometry tools to the problems of control of remotely piloted aircrafts in conjunction with generation of the optimal combat scenario. These problems are intractable, employing conventional approaches because of the number of variations to be generated and evaluated.

In this report we introduce two examples of such problems. In the first, simplified example, the aircrafts move in a serial mode, one aircraft at a time, and motions of opposing sides alternate. A dramatic search reduction, from a million variations down to 50, achieved in this problem allows us to introduce concurrency inherent to the real world combat. In the second example, all the aircrafts, cooperating and opposing, can move concurrently. This results in a significant growth of the branching factor (up to 300) because all the combinations of simultaneous motions are legal. Another difficulty (in the second example) is that each side when moving is uncertain about the concurrent motions of the opposing side. The Linguistic Geometry tools solved this problem, demonstrating a dramatic reduction of the branching factor, from 324 to 1.52.

Results of the summer research are reflected in 7 research papers. Two of these papers were submitted to research journals and four – to international conferences. Conference papers have been accepted for presentation and publication in USA, France, Turkey, and Greece. One of this papers is co-authored by Capt. Dr. Doug Dyer from the Air Force Phillips Laboratory. This is an invited paper to be presented at the 5th International Conference on Human-Machine Interaction and Artificial Intelligence in Aerospace to be held in Toulouse, France, in September 1995.

Results of the research allowed us to initiate the development of a software prototype of the system for simulation and control of the real world aerospace combat with participation of aircrafts, satellites, and UAVs. This work is currently under way at the Air Force Phillips Laboratory, Kirtland AFB, NM, and will continue in collaboration with the University of Colorado at Denver and Sandia National Laboratories.

Pentafluorobenzoylation And Mass Spectroscopic Analysis Of Selected Amphetamines

John G. Stuart
Associate Professor
Division of Natural Sciences
Wiley College

Abstract

A selected series of amphetamine compounds (1-phenyl-2-aminopropanes) was pentafluorobenzoylated utilizing stoichiometric amounts of substituted amines (amphetamines or their hydrochlorides), pentafluorobenzoyl chloride, and triethylamine in dichloromethane at 65°C for 1 hour. The reaction mixtures, after washing with water and drying over anhydrous sodium sulphate, were evaporated under a stream of nitrogen using a Zymark Turbo LV Evaporator. The resulting solids or residues were reconstituted in ethyl acetate and the samples were subjected to mass spectroscopic analysis utilizing basically three methods: EI- Electron Ionization, PosCI- Chemical Ionization with positive ions and NICI- Negative Ion Chemical Ionization. Considering the information obtained, fragmentation mechanisms were proposed.

HEAVY-HOLE SCATTERING BY CONFINED NONPOLAR OPTICAL PHONONS IN A SINGLE $Si_{1-x}Ge_x$/Si QUANTUM WELL

Gang Sun
Assistant Professor
Engineering Program/Physics Department
University of Massachusetts at Boston

ABSTRACT

Intrasubband and intersubband scattering rates of heavy holes are obtained due to confined nonpolar optical phonons in a $Si_{1-x}Ge_x$ quantum well with Si barriers. Guided and interface Ge-Si and Ge-Ge modes and unconfined Si-Si modes are considered. A continuum model is used for the two components of the ionic displacement of confined vibrations: the uncoupled s-polarized TO mode and the hybrid of the LO and p-polarized TO modes. The guided mode is obtained using the model of a quantum well with infinitely rigid barriers, and the interface mode is derived from the hydrodynamic boundary conditions. While the total intersubband scattering rates are reduced as a result of confinement, the opposite is found for the intrasubband scattering. Depending on the well width and Ge content, the intersubband scattering rates are reduced by a factor of two to four with respect to their values for no confinement. Thus, one would expect comparable enhancement in the intersubband lifetimes crucial to the population inversion in a $Si_{1-x}Ge_x$/Si intersubband laser.

ADVANCED PROCESSING TECHNIQUES FOR RESTORATION AND SUPERRESOLUTION OF IMAGERY IN MULTISPECTRAL SEEKER ENVIRONMENTS

Malur K. Sundareshan
Professor of Electrical and Computer Engineering
University of Arizona
Tucson, AZ 85721

ABSTRACT

This report summarizes the results of a study undertaken to investigate the potential for restoration and superresolution processing of images in multispectral seeker environments for facilitating smart munition guidance. Despite the advances being made in sensor technology, the inherent problems associated with diffraction limited imaging impose limitations on the resolution of acquired imagery thus necessitating some form of post-processing to achieve resolution improvements needed for reliable target detection , classification and aimpoint selection. A mathematical formulation of the restoration and superresolution problems from a frequency spectrum reconstruction viewpoint is given to identify certain critical factors that affect the superresolvability of given image data. Processing characteristics of a few promising approaches for developing systematic algorithms that can be tailored to process image data collected from different types of sensors in multispectral missile seekers are outlined. A brief discussion of the computational requirements and optimization of processing architectures for supporting the implementation of algorithms is given. The role of superresolution processing to facilitate sensor fusion is also outlined. The principal focus of this study is to underscore the importance of optimally tailored restoration and superresolution algorithms for the individual sensor type and operating conditions.

ANALYZING CONSTANT FALSE-ALARM RATE SAR IMAGE TARGET DETECTORS

John A. Tague
Associate Professor
School of Electrical Engineering and Computer Science
Ohio University

Abstract

Many automatic target recognition systems use a prescreening algorithm to identify image segments which may contain interesting objects. Its performance can be quantified by a receiver operating characteristic - a plot of detection probability versus number of false alarms per square kilometer of imagery. Recently, a constant false alarm rate prescreener was tested on images formed at several different resolutions. We can be confident that the experimental results are not an "artifact" of the particular data set. Furthermore, under certain conditions, theory validates the experimental trends.

HARD TiC COATINGS PREPARED BY PULSED LASER DEPOSITION AND A COMPARISON WITH MAGNETRON SPUTTERED TiC COATINGS

Jinke Tang
Associate Professor
Department of Physics
University of New Orleans

Abstract

Tribological properties of TiC coatings grown by pulsed laser deposition (PLD) and magnetron sputtering were investigated. The PLD TiC coatings grown at room temperature were found to be much harder than the TiC films grown by magnetron sputtering under similar conditions. The hardness of PLD TiC coatings measured by a nanoindentation test was as high as ~40 GPa in contrast to ~20 GPa of the magnetron sputtered ones. The coefficient of friction of the PLD films measured with a pin-on-disk type tribometer had a typical value of about 0.2 when using a 440C stainless steel pin. Scratch tests indicated that magnetron sputtered TiC coatings adhere better to the stainless steel substrate than the PLD grown coatings. The relatively poor adhesion of the PLD coatings obtained from this scratch test was probably partly due to its high hardness. The adhesion of magnetron sputtered TiC coatings could be modified by inserting a metallic interlayer between the coating and stainless steel substrate. Mo interlayer had a detrimental effect on the adhesion caused probably by the poor stress bearing capability of the porous Mo film deposited at low temperature. However, the insertion of both Ti and Cr interlayers enhanced the adhesion of TiC, by as much as 25%.

NON-LINEAR RESPONSE OF AN INTENSIFIED CHARGE-COUPLED DEVICE (ICCD) CAMERA TO NANOSECOND LASER PULSES

John T. Tarvin
Associate Professor
Department of Physics and Astronomy

Abstract

Dual-wavelength planar laser-induced fluorescence (PLIF) measurements of shock flows provide a non-invasive technique for the visualization of temperature profiles within such flows. These measurements typically use an intensified charge-coupled device (ICCD) camera to record ultra-violet (uv) fluorescence images excited by a Nd:YAG/dye laser system. The response of this camera system requires "flat-fielding" of the images due to significant variations of the camera response function across the field of view. It has been determined that the commercially-obtained cameras in the PLIF system used for the present study are non-linear in their response. This non-linearity is most pronounced over the upper 75% of the dynamic range of these cameras; camera response can be considered essentially linear only over the lower 20-25% of the camera range. This non-linearity is only present when camera images are obtained using laser pulses (order of 10 ns) as an illumination source; continuous wave (cw) illumination with a deuterium lamp source provides a linear response over the full dynamic range of the ICCD camera. All images were obtained using uniform illumination from a Lambertian plate. All camera variations across the image are correctable using standard flat-fielding techniques; the resulting correction image is independent of the illumination source provided the camera is operated within its linear response region.

Pentafluorobenzoylation And Mass Spectroscopic Analysis Of Selected Amphetamines

John G. Stuart
Associate Professor
Division of Natural Sciences
Wiley College

Abstract

A selected series of amphetamine compounds (1-phenyl-2-aminopropanes) was pentafluorobenzoylated utilizing stoichiometric amounts of substituted amines (amphetamines or their hydrochlorides), pentafluorobenzoyl chloride, and triethylamine in dichloromethane at 65^{o}C for 1 hour. The reaction mixtures, after washing with water and drying over anhydrous sodium sulphate, were evaporated under a stream of nitrogen using a Zymark Turbo LV Evaporator. The resulting solids or residues were reconstituted in ethyl acetate and the samples were subjected to mass spectroscopic analysis utilizing basically three methods: EI- Electron Ionization, PosCI- Chemical Ionization with positive ions and NICI- Negative Ion Chemical Ionization. Considering the information obtained, fragmentation mechanisms were proposed.

HEAVY-HOLE SCATTERING BY CONFINED NONPOLAR OPTICAL PHONONS IN A SINGLE $Si_{1-x}Ge_x$/Si QUANTUM WELL

Gang Sun
Assistant Professor
Engineering Program/Physics Department
University of Massachusetts at Boston

ABSTRACT

Intrasubband and intersubband scattering rates of heavy holes are obtained due to confined nonpolar optical phonons in a $Si_{1-x}Ge_x$ quantum well with Si barriers. Guided and interface Ge-Si and Ge-Ge modes and unconfined Si-Si modes are considered. A continuum model is used for the two components of the ionic displacement of confined vibrations: the uncoupled s-polarized TO mode and the hybrid of the LO and p-polarized TO modes. The guided mode is obtained using the model of a quantum well with infinitely rigid barriers, and the interface mode is derived from the hydrodynamic boundary conditions. While the total intersubband scattering rates are reduced as a result of confinement, the opposite is found for the intrasubband scattering. Depending on the well width and Ge content, the intersubband scattering rates are reduced by a factor of two to four with respect to their values for no confinement. Thus, one would expect comparable enhancement in the intersubband lifetimes crucial to the population inversion in a $Si_{1-x}Ge_x$/Si intersubband laser.

ABSTRACT

PHOTOLUMINESCENCE STUDIES OF THE RIGID ROD POLYMER
Poly (p-phenylenebenzobisthiazole)(PBZT)

Barney E. Taylor
Visiting Assistant Professor
Department of Physics
Miami University - Hamilton

Poly (p-phenylenebenzobisthiazole)(PBZT) is a rigid rod polymer with excellent thermal and mechanical properties. A previous study characterized electroluminescent devices with PBZT as the active layer fabricated upon an indium-tin oxide (ITO) coated glass slides. In the previous study, the spectral studies showed an emission from 850 nm (the long wavelength limit of the apparatus) up through about 525 (nm) at device voltages ranging from 2.35 V to 4.0 V for various devices studied. This report describes a systematic investigation of the photoluminescence (PL) of PBZT to complement the electroluminescent studies performed earlier.

A number of different PBZT samples were studied by room temperature photoluminescence. A systematic study of the PL of one sample was performed over the range of -163 ^{o}C to 291 ^{o}C. Analysis of the temperature dependence of the PL spectra indicate a thermally activated process with an activation energy of 83 meV. Some structure was observed in the PL spectrum of PBZT, and a process of fitting multiple gaussian lineshapes to identify the relative intensity and width of each component was undertaken. Very consistent fitting results were obtained. The physical significance of the variation of the components with temperature is not immediately evident and further studies are required.

The relatively low electroluminescent yield of the PBZT devices in the earlier study has led to a desire fabricate electroluminescent devices based upon other polymers that, hopefully, have a higher quantum efficiency. PL appears to be very useful as a screen for likely polymer EL candidates.

EVALUATION OF CONCRETE BURST DAMAGE ALGORITHMS IN EVA-3D

Joseph W. Tedesco
Gottlieh Professor
Department of Civil Engineering
Auburn University

Abstract

EVA-3D is an effectiveness/vulnerability computer program which contains several algorithms for a prediction of damage sustained by hard target concrete structures subject to bursts in air, soil, and concrete. These algorithms were evaluated for their validity and accuracy. For the most part, these algorithms were not developed from sound engineering practices and extended available hard target vulnerability data beyond their limitations without implementation of a valid methodology. Future damage assessment algorithms should be based upon well established numerical and material models, and should be verified with existing hard target data.

Structural Operational Semantics for a VHDL-93 subset

Krishnaprasad Thirunarayan
Associate Professor
Department of Computer Science and Engineering
Wright State University

September 25, 1995

Abstract

Goossens defined a structural operational semantics for a subset of VHDL-87 that includes delta delays, arbitrary wait statements, and (commutative) resolution functions. A monogenicity result was proved showing that the parallelism present in the VHDL is benign.

In this paper, we correct and extend Goossens work to include VHDL-93 features such as shared variables and postponed processes that change the underlying semantic model of VHDL. The monogenicity result does not hold in general when shared variables are introduced. However, we identify and characterize a class of *portable* programs for which the monogenicity result can be salvaged. Our specification can serve as a correctness criteria for the VHDL-93 simulator.

QUASI-STEADY STATE THERMAL RESISTANCE OF A FLEXIBLE COPPER-WATER HEAT PIPE SUBJECTED TO TRANSIENT ACCELERATION LOADINGS

Scott K. Thomas
Assistant Professor
Department of Mechanical and Materials Engineering
Wright State University

Abstract

The thermal performance of a flexible copper-water heat pipe has been investigated to determine its quasi-steady state characteristics under varying acceleration loadings. This was accomplished by attaching the heat pipe to a centrifuge table, where the imposed angular velocity was sinusoidal in nature. It was found that the thermal resistance of the heat pipe is a function of the acceleration frequency, heat input, condenser temperature, and dryout condition prior to changing the frequency. The objective of the present experimental study is to determine the potential performance characteristics of heat pipes used as heat sinks in transient acceleration environments typical of those seen in high-performance aircraft. In addition, this research will enable heat pipe designers to re-examine the effects of acceleration loadings with respect to heat pipe wick and containment structures, so that new wicks and heat pipe shells can be developed and designed specifically for exploitation of the phenomena which occur in transient acceleration fields.

REGRESSION TO THE MEAN IN HALF-LIFE STUDIES

Ram C. Tripathi
Professor
Department of Mathematics and Statistics
University of Texas at San Antonio

Abstract

Half-life studies of biomarkers for environmental toxins in humans are generally restricted to a few measurements per subject taken after the initial exposure. The initial dose is usually unknown because the exposure occurred before the substance was known to be toxic. In this setting, subjects are selected for inclusion in the study if their measured body burden is above a threshhold (c) determined by the distribution of the biomarker in a control population. We assume a simple one-compartment first order decay model and a log-normal biomarker distribution , which together imply a repeated measures linear model relating the logarithm of the biomarker and time, with the slope being the negative of the decay rate (λ). Unless the data is properly conditioned, we show that ordinary weighted least-squares estimates of λ are biased due to regression toward the mean. These results are applied to show that published estimates of TCDD half-life in veterans of Operation Ranch Hand are biased. Based on these results an unbiased estimate is presented.

Key words: biomarker, half-life, regression toward the mean

EVALUATION OF A REVISED TAXONOMY IN RESEARCH ON CROSS-JOB TRANSFERABILITY OF SKILLS

Stephen A. Truhon
Associate Professor
Department of Social Sciences
Winston-Salem State University

ABSTRACT

An examination was made of a revised 45-category taxonomy of tasks performed by Air Force personnel. Retrainees, supervisors and co-workers of these retrainees, as well non-retrainees representing Air Force specialties from which the retrainees were transferred participated in the study. They completed a questionnaire asking three or five questions about each of these task categories as well as other questions. Results showed the taxonomy has face validity, is reliable, is distinctive, and is useful in conducting research on cross-job transferability of skills. However, the reliability of several of the items as well as the low response rate suggest that this taxonomy be shortened in future studies.

A STUDY OF THE IMPLEMENTATION OF RESEARCH EPIC ON CRAY-T3D MASSIVELY PARALLEL COMPUTER USING PVM

C. T. Tsai
Associate Professor
Department of Mechanical Engineering
Florida Atlantic University

Abstract

Research EPIC code can be mostly parallelized except the slide interface algorithm. A PVM EPIC code which executes the parallel algorithm of EPIC in many PEs of T3D while executes the sequential algorithm in one PE of T3D or YMP will improve the speedup of the whole EPIC code. The PVM EPIC will also be a portable code which can be implemented to any cluster of computer network. A initial study is performed by executing 2 paralleled subroutines (SOLID and VOLUME) on the T3D while executing the rest of the EPIC code on either the YMP or one PE of T3D. The results obtained from this initial study show that for an example having 40% of the code being paralleled, the CPU time for running the new PVM EPIC in T3D is about 2 times more than the one for running the sequentrial EPIC in YMP. It indicates that this PVM EPIC in T3D can run as fast as the sequentrial EPIC in YMP if 80% of the code are executed in parallel. When 90% of the code are executed in parallel, the PVM EPIC in T3D can double the speed of sequential EPIC in YMP. This goal can be accomplished by converting more EPIC subroutines into parallel program. This study encourage continuous works to parallel more EPIC subroutines and implement into the PVM EPIC to enhance the high performance computing of EPIC.

ORGANIZED SUPRAMOLECULAR STRUCTURES IN ORGANIC AND POLYMERIC MATERIALS

DR. VLADIMIR V. TSUKRUK

Associate Professor

COLLEGE OF ENGINEERING AND APPLIED SCIENCES

WESTERN MICHIGAN UNIVERSITY

Abstract

In the present work we explore organized molecular films of various polymeric materials, dye molecules, and NLO materials built by self-assembling electrostatic deposition and cyclic liquid crystalline (LC) compounds with mesogenic groups attached to cyclic siloxane rings.

It has been demonstrated that a relatively thick (up to 200 nm), rather smooth and homogeneous self-assembled films for copper phthalocyanine dye molecules and synthetic polypeptide, polylysine, can be fabricated by electrostatic layer-by-layer deposition. Microroughness of these films does not exceed 3 nm and a bilayer of 2 nm thick is formed by flexible polylysine fragments and phthalocyanine molecules. Kinetics of formation of self-assembled monolayers was monitored for polystyrene sulfonate (PSS) and polyallylamine (PAA) polymers adsorbed on charged surfaces. A gradual coverage of the surface by isolated polymer islands was observed within the time interval of 5 minutes followed by a formation of an incomplete monolayer film. The processes observed is reminiscence of growth controlled by diffusion limited aggregation.

Computer simulation of cyclic LC compounds reveal some features of their structural behavior in the mesomorphic state. Analysis of X-ray data shows that a variety of scattering phenomena can be explained by overlapping of modulated molecular form-factor with sharper singularities due to association of several molecules along the c-axis ("strings"), presence of siloxane rings with very high scattering power, and lattice factor with body-centered symmetry. A lattice factor features very small lattice sizes (L = 20-30Å) and large distortion (g = 10%) along the a and b-axes and limited correlations along the c-axis: L = 100 - 300Å and g = 2 - 4%. The attachment of mesogenic groups to the ring breaks a symmetry of molecules that results in systematic extinction of odd orders of Bragg reflexes along the c-direction (001, 003, 005 ...) observed for all cyclic compounds studied.

Electromechanics of Segmented Cylindrical Piezoelectric Sensor/Actuator Patches

H. S. Tzou[1], Y. Bao[1], and V. B. Venkayya[2]

[1] Department of Mechanical Engineering
University of Kentucky
Lexington, KY 40506–0046

[2] Wright Laboratory
Flight Dynamics Directorate
WL/FIBA, WPAFB Ohio 45433

ABSTRACT

Spatial characteristics, modal sensitivities, modal filtering, curvature effects, etc. of distributed segmented cylindrical sensor/actuator patches are investigated. A sensor equation suggests that the sensor signal is determined by a number of factors, such as geometries, material properties, mode numbers, sensor locations, spatial distributions, strains, etc. The total sensor sensitivity is composed of a membrane sensitivity and a bending sensitivity which are respectively related to induced membrane strains and bending strains. A number of sensor parameters (e.g., sensor thickness, shell thickness, curvature angles, shell sizes) are evaluated, and their membrane, bending, and total sensitivities are compared. Modal control forces of segmented actuator patches are derived and evaluated. Modal actuation factor, modal feedback factor, and controlled damping ratio are derived and their detailed membrane and bending actuations are evaluated with respect to actuator design parameters: actuator thickness, shell lamina thickness, shell curvatures, shell sizes, and natural modes.

FEASIBILITY OF AUTOMATING METHOD APC 44

FOR THE DETERMINATION OF TOTAL GLYCOLS IN WATER

Sailaja Vallabha
Lecturer
Department of Natural Sciences
Fayetteville State University

Abstract

This study investigates the feasibility of automating the EPA method APC 44, used for the determination of total glycols in water samples. The study included investigating the importance of the various steps involved in the analysis and the reagents used in the analysis. It was crucial to understand the chemistry involved in following the sequence of steps for the addition of the reagents in this analysis. Automation of this method will drastically reduce the amount of time spent by an analyst in the sample preparation and the analysis thus reducing the cost. Moreover it would eliminate the waste generated, cut back the amount of reagents used and the glassware needed. Thus the analysis when automated will be cheaper, faster, safer, easier and most important will be environment friendly.

The APC 44 method determines the total amount of glycols present in the water sample by first converting the hydroxy-methyl groups of the glycols to formaldehyde by the periodate scission. In the next step any unreacted and excess of periodate is quenched by the sodium bisulfite. This is followed by the use of chromotropic acid method which forms a purple colored complex with the formaldehyde. Spectroscopy is used to colorimetrically determine the amount of total formaldehyde present in the samples. Any interfering formaldehyde is determined separately by omitting the oxidation step and by carrying out the chromotropic step alone. The difference between these two values will be indicative of the glycol that was converted to formaldehyde.

COATINGS SYSTEM EVALUATION AND DEVELOPMENT

Michael R. Van De Mark, Director

University of Missouri-Rolla Coatings Institute

Abstract

The total coatings system utilized by the Oklahoma City Air Logistics Center was evaluated and studied. The system included the paint stripping, aircraft washing, skin brightening, chromate conversion coating, priming and painting steps. The problems isolated included: the incomplete removal of the paint, primer and cellulosic debris in the paint stripping operation; the ability of the soap to remove the oil from the underside of the wings in the washing step; the inability of the current chromating solution to produce a significant degree of conversion coating; and the need to have abrasion during the cleaning and skin brightening steps. The problems were evaluated by FT-IR and the use of spectrophotometric reflectance analysis of the chromated surface and the use of torque adhesion measurements to correlate the findings.

Optical Sensor Research in the Environics Sensors Program

Brian S. Vogt
Professor
Department of Chemistry

Abstract

The purpose and focus of the Environics Sensors Program at Armstrong Laboratory (AL/EQ) are described. Previous research efforts have resulted in a uniquely designed laser probe that has been interfaced to a column and used to monitor the flow of contaminant plumes through sand packed into the column. Several improvements have been made to the laser-spectrometer sensor system and the laser probe. Work in progress centers on obtaining soil-column data to test a mathematical model developed by the Fate and Transport Group. This model describes the interactions of contaminants with layered soils. A full report was filed on base that details the accomplishments and potential research directions of the Sensors Group.

A Recurrent Neural Network for Aircraft Fault Classification Based on the Bayesian Decision Theory

Jun Wang

Department of Industrial Technology
University of North Dakota
Grand Forks, ND 58202-7118

Abstract

A Bayesian/neural-network approach is developed for aircraft fault classification. From historic maintenance data, the posterior probabilities of fault classification based on given fault indicator are estimated and derived using the Bayes' rule. Based on the Bayesian decision theory, the fault classification problem is formulated as a linear integer programming problem to minimize an expected loss function with the posterior probabilities. The linear integer programming problem is then convert equivalently to a standard linear programming problem. A two-layer recurrent neural network is used to carry out the computation task for fault classification by solving the formulated linear programming problem. The simuiation results of a pilot study based on the historic data on the radar system in F-16 aircraft show that the neural network approach is capable of real-time aircraft fault classification.

Inversion of Atmospheric Radiance Measurements for the Measurement of Temperature, Velocity, and Turbulence: A Preliminary Study

David W. Watt
Associate Professor of Mechanical Engineering
Kingsbury Hall
The University of New Hampshire
Durham, NH 03824

Abstract

The feasibility of multi-spectral imaging of atmospheric radiance for remotely detecting turbulence and wind fields was studied. A model for fluctuations in atmospheric radiance is proposed, and an approach to inversion of atmospheric radiance data to obtain temperature, turbulence structure parameter, and velocity profiles is discussed. The approach is based on the assumption of locally isotropic turbulent mixing, which gives the instantaneous temperature field a predictable statistical structure. A preliminary assessment of the feasibility of the technique is presented and prospects for further research are discussed.

A HYBRID MM/GTD NUMERICAL TECHNIQUE FOR LOSSY DIELECTRIC ROUGH SURFACE SCATTERING CALCULATIONS

James C. West
Associate Professor

James Michael Sturm
Graduate Research Assistant

School of Electrical and Computer Engineering
Oklahoma State University

Abstract

A hybrid numerical technique combining the moment method and the geometrical theory of diffraction has been extended to allow the calculation of electromagnetic scatter from lossy dielectric surfaces. The hybrid technique eliminates the non-physical edge effects that are introduced in standard moment method implementations, thereby allowing the application at extreme grazing angles. The dielectric surface is represented using impedance boundary conditions. Sample calculations demonstrate the reduction in scattering from a rounded-apex wedge when the surface conductivity is reduced. The technique should allow more realistic calculation of the scattering from land and water surfaces than can be obtained using a perfectly conducting surface.

THERMODYNAMIC EVALUATION OF EFFLUENT TAILING EFFECTS IN DISSOLUTION OF BINARY OIL MIXTURES

William R. Wise
Associate Professor
Department of Environmental Engineering Sciences
University of Florida

Abstract

Local equilibrium with linear interphase partitioning models have failed to describe adequately the dissolution of binary and multi-component oils in groundwater systems. Specifically, the major features not described by such models are persistent tailings of the more soluble components in the effluent concentration histories. To date, the environmental research community has addressed these shortcomings by invoking nonequilibrium models based upon linear partitioning at equilibrium. However, local equilibrium models with nonlinear partitioning have also shown some promise for mimicking tailing phenomena; the degrees of nonlinearity involved can be quite subtle. Critical evaluation of the thermodynamics of nonlinear partitioning in the context of chromatographic theory yields a criterion delineating for binary oils where nonlinear-partitioning induced tailing may be ruled out. Specifically, this condition is met when both components of an oil have enhanced solubility, relative to Raoult's law, as a result of their complementary components. This criterion serves as a proof of the link between nonequilibrium effects and observed tailing phenomena for this class of binary mixtures. Furthermore, such mixtures should be the rule and not the exception, given the nature of partitioning phenomena observed for most mixtures of chemically dissimilar compounds.

DISTRIBUTION-BASED EVALUATION AND ASSESSMENT OF MISSION READINESS FOR THE EVALUATION OF PERSONNEL TRAINING

David J. Woehr
Associate Professor
Department of Psychology
and
Michael J. Miller
Department of Psychology

Texas A&M University

Abstract

The present paper briefly summarizes a research project focusing on ways to improve the usefulness of organization level outcome measures of unit readiness/effectiveness for the evaluation of personnel training interventions. Toward this goal, a measurement approach using organization level outcome measures is presented. It is suggested that an adaptation of this approach has the potential to improve the utility of organization level criterion measures. In addition, potential sources of data for the evaluation of training interventions at the organization level are identified and evaluated.

DEVELOPMENT OF A COST-EFFECTIVE ORGANIZATIONAL SUPPORT SYSTEM BASED ON THE WORLD WIDE WEB: A CASE STUDY

Michael D. Wolfe
Assistant Professor
Department of Management
West Virginia University

Abstract

Two new events central to re-engineering the data flows in organizations have instigated new research directions in organizational support systems: the first is the advent of PC databases with their relatively easy to use interface. This has lowered the cost of developing and maintaining electronic databases, which is leading to the creation of a large number of distributed electronic databases, collected and maintained by individual sections of the organization, but with information needed throughout the organization. The second event is the advent of the Internet and the World-Wide Web, which provides a new and very cost-effective channel for disseminating this information, if one considers marginal costs, rather than total costs. Marginal costing is more appropriate for decision making.

This case study examines how a small organization in the Air Force, responsible for collecting, maintaining, and disseminating information about automatic test systems (ATS) to the entire Air Force used the World Wide Web to re-engineer their customer support function. The Web replaces a process of mailing several floppy disks to more than 500 end-users several times a year. This savings is achieved at almost no marginal cost for the Air Force.

The research followed a "bottoms-up" approach, looking at some of the new tools available on the World Wide Web, and how they might most effectively be used in an organizational support system. In addition to the data distributed by mailing out floppy disks to users, the lower cost of providing information via the Web allowed the section to make additional databases and knowledgebases available to the entire organization.

As a result of this research, the organization will begin the development of a system to disseminate its data and receive customer feedback via the World Wide Web.

EVALUATION OF:
OPEN ARCHITECTURE MACHINE TOOL CONTROLLERS
&
AGILE MANUFACTURING

William J. Wolfe
Associate Professor
Computer Science and Engineering
University of Colorado at Denver

Abstract

This report provides an evaluation of the Open Architecture Machine Tool Controllers and Agile Manufacturing programs. The most interesting result is that the concept of the *open architecture* with interoperable/portable *agents*, developed for the Open Architecture Program, can also provide a much needed structure for the Agile Manufacturing Program. Both programs deal with a wide variety of functional components that must *evolve* in an uncertain technological environment. Specifying the design of these components is greatly complicated by a rapidly changing technology base. It is almost impossible to predict the performance of a particular module without testing it over a period of time in a wide range of operational environments (*portability* and *interoperability*). The *open architecture* strategy provides the necessary interface information so that many independent developers can evaluate their modules. The strategy does not commit to any particular design, it just provides the *playing field* (i.e.: interface specifications). The clients submit their modules for testing: performance? interoperability? portability? The *best* modules will survive the test of time. This strategy encourages many *third party players*, thus tapping a diverse network of developers. Furthermore, the rapidly emerging client/server networking technology (internet, world-wide web, etc.) will provide the necessary communications infrastructure for the many geographically dispersed developers. The Open Architecture Machine Tool Controllers program has come a long way in identifying and implementing these concepts. The Agile Manufacturing program can benefit greatly by following this lead.

DEFECTS IN SPUTTER DEPOSITED MGO FILMS AS CAPPING LAYER FOR DEPOSITING HIGH TEMPERATURE SUPERCONDUCTING FILMS ON GAAS

Peter Ka-Chai Wu
Assistant Professor
Department of Physics
Southern Oregon State College

Abstract

Future developments in superconductor-semiconductor microwave devices depend on depositing high-quality high-temperature superconductor (HTS) thin film on semiconductors. Buffer layer technology using Y-stabilized ZrO_2 (YSZ) as a buffering layer and MgO as a capping layer is one of the most promising processes for growing HTS such as $Yba_2Cu_3O_{7-\delta}$ (YBCO) on GaAs substrate. The superconducting properties of YBCO depend on the quality of the buffer layer, i.e. c-oriented, smooth, and free of defects, which in turn depends on the quality of the capping layer. The defect structure in the MgO capping layer deposited by sputtering is examined in the present study. Defects such as pin holes, precipitates, impurity induced structures, bubbles, and steps are identified. Films with pin holes are found to be ineffective as a chemical barrier. They are also poor templates for growing c-oriented YSZ films. Other defects only have localized effects with no observable structural effects on the YSZ buffer layer. Pin holes in the MgO layer can be eliminated by reducing the target to sample distance.

A FINITE-VOLUME, TIME-DOMAIN FORMULATION FOR WIDE-BAND RCS PREDICTION

Jeffrey L. Young
Assistant Professor
Department of Electrical Engineering
University of Idaho

Abstract

A finite–volume, time–domain code for radar cross–section (RCS) prediction (authored by J. S. Shang) was further developed. Specifically, the modified code is presently capable of simulating wide–band input pulses and calculating RCS information over a band of frequencies. The post–processing RCS routine was completely rewritten; the new routine is based upon the equivalence theorem for far–field power observations. The scattering object under investigation was a perfectly conducting sphere; various electrical sizes were considered. The data obtained from the code was in agreement with the exact Mie solution.

In addition to code development, a new numerical boundary condition for collocated schemes was postulated. This new condition shows explicitly the relationships between the surface charge, surface currents and the tangential electric field. By having such a condition, we circumvent the extrapolation process used currently. Validation of this concept is in progress.

INVESTIGATION ON SCHEDULING ISSUES UNDER MANUFACTURING ENVIRONMENT AT MANUFACTURING AND INDUSTRIAL SERVICES DIVISION OF MCCLELLAN AIR FORCE BASE

Norman D. Zhou
Associate Professor
Technology Department
University of Wisconsin-Stout

Abstract

Under manufacturing environment, the efficiency of our operations is the key to meet cost, schedule and performance commitments. In this paper, investigations on scheduling issues were conducted at the manufacturing and industrial services division. The current scheduling practices at machine shops, paint shop and T38 windshield frame production are studied. Shortcomings of manual scheduling and advantages of using a scheduling software are addressed. Then a windows-based user-friendly scheduling software is presented. The software employs scaling neural network algorithm developed by the author with improvements to handle parallel machines, operation-split/operations-combined situations. Two examples are shown in detail. As a result, it is recommended that all shops and all operations use Gantt charts to create job charts and schedule charts in order to optimize efficiency and productivity. After successful installation of a paper-based system, scheduling software with optimization capability is proposed.

MISSILE AUTOPILOT DESIGN BASED ON A UNIFIED SPECTRAL THEORY FOR LINEAR TIME-VARYING SYSTEMS

J. Jim Zhu
Assistant Professor
Department of Electrical and Computer Engineering
Louisiana State University

Abstract

This report presents design and simulation case studies of a missile autopilot for angle of attack and nominal acceleration tracking using a recently developed Extended-Mean Assignment (EMA) control technique for linear time-varying (LTV) systems. The EMA control technique is based on a new eigenvalue concept, called SD-eigenvalue, for LTV systems. Closed-loop stability is achieved by the assignment of the extended-mean of these time-varying SD-eigenvalues to the left-half complex plane in a way similar to the eigenvalue (pole) assignment technique for linear time invariant (LTI) systems. Salient features of the tracking controller include: (i) good tracking performance for arbitrary trajectories without any scheduling of the constant design parameters throughout the entire operating range of the Mach, (ii) implementation of the inverse pitch dynamics using a static neural network, (iii) time-varying EMA control gains to improve tracking performance, and (vi) a time-varying bandwidth command shaping filter that effectively reduces the actuator rate while maintaining good tracking response for both smooth and abrupt trajectories. Although the autopilot was designed only for nominal aerodynamic coefficients and constant trajectories, excellent performance was verified for $\pm 50\%$ variations in the aerodynamic coefficients, and for arbitrary command trajectories.

DEVELOPMENT OF IONOSPHERIC TOMOGRAPHY RECONSTRUCTION ALGORITHMS USING A THREE DIMENSIONAL IMAGING VOLUME

Vala Afshar
B.S., University of Massachusetts Lowell
Department of Electrical Engineering

Abstract

The basic assumption in most ionospheric tomography algorithms is that the ground stations, and satellite orbit are approximately coplanar. However, typical ray paths from the receiver, to an orbiting satellite are not coplanar. Real world receiver locations are determined by convenience and availability of sites, and depending on the orbit involved, the satellite could be as much as 20 degrees removed in longitude from the chain of receivers. Therefore the receivers will not all be in a line, nor will they be directly under satellite passes. Thus the total electron content *(TEC)* data ray paths may have passed through regions of the ionosphere far different from an assumed *imaging plane*. If these "real world" geometric considerations are not addressed, it is possible that certain details of the ionosphere, such as small-scale features, will not be accurately reconstructed in the presence of highly non-coplanar geometry.

In this project, a robust and efficient algorithm to allow three-dimensional reconstruction was developed. The algorithm utilizes a three-dimensional *imaging volume*. The linear relationship between measured *TEC* data and electron density has been extended to a full three dimensional case, where the lengths of the ray paths are from the orbiting satellite to the ground-based receiver, through a discrete *imaging volume*, are represented as the elements of a *matrix A*.

COMPARISON OF DIRECT AND DOWNCONVERTED DIGITIZATION IN GPS RECEIVER FRONT END DESIGNS

James B. Y. Tsui
WL/AAWP-1

Dennis M. Akos
Ohio University

Abstract

This paper compares two front end designs of a global positioning system (GPS) receiver. The first approach is the direct digitization of the input signal and the second approach is to downconvert the input signal to an intermediate frequency (IF) then digitize it. Theoretically, these two methods should produce similar results and our experimental data support this argument.

A STUDY OF LG ATTENUATION IN THE VICINITY OF THE KYRGYZ ARRAY, KYRGYZSTAN

Thomas S. Anderson
Graduate Student
Department of Geology and Geophysics
University of Connecticut

Abstract

The regional variations of Lg efficiency in the vicinity of the Kyrgyz array was studied. Data recorded by the Kyrgyz array with paths that crossed a variety of Moho gradients are examined for possible effects due to blockage or leakage of energy. The frequency range 1-5 Hz has been studied. The seismograms show an azimuthal dependence in both amplitude and coda length. 3-D Ray tracing is used to illustrate the azimuthal dependency of Lg due to steep gradients in Moho topography. The strongest variations of Lg coda both in observed data and predicted from ray theory are associated with ray paths that pass through crustal regions with strong gradients in Moho topography along the Hindu Kush and Pamir mountain regions. A value for total Q (seismic attenuation) is sought using a reflectivity program with a current velocity model of the region east of the kyrgyz network where the Moho topography is nearly flat. Comparisons of synthetics to real seismic data with the same source receiver geometry lead to Q values of 70 - 450 for the crust.

AMBIGUITY AND CONFLICT
IN
INFORMATION SYSTEMS DEVELOPMENT -
A CASE STUDY OF WEATHER DATA INTEGRATION

Raymond J. Barnes
PhD Candidate
Dept. of Industrial Engineering and Systems Science
Binghamton University

Abstract

An analysis of ambiguity and conflict in Information Systems Development (ISD) is performed through a case study involving specification of functional requirements for a common Weather Toolkit (WxTK). The WxTK will allow Air Force geographic information system applications to automate the integration of on-line digital weather data. Given the potentially diverse range of application needs the WxTK would serve, ambiguity inherent in function specifications may obscure important issues, leading to conflicts during later phases of development. In defining the WxTK architecture and library functions the research addresses current ambiguities about what the system must do, and identifies potential conflicts involving the design and implementation of the WxTK. Importantly, ambiguity and conflict per se are not deemed as "good" or "bad", but rather inherent components of systems development in an environment of rapid technological change and volatile user needs. By recognizing the significance of clarifying development issues at requirements specification time, unanticipated conflict may be minimized during the design (building) and implementation phases. The research provides the foundations of a comprehensive framework for dealing with requirements ambiguity and conflict.

ANTIMONOTONICITY IN DRIVEN NONLINEAR ELECTRONIC DIODE CIRCUITS

Paul M. Bennett
Department of Mathematics and Statistics
University of New Mexico
Albuquerque, New Mexico 87131

Abstract

An investigation of antimonotonicity [S. P. Dawson, C. Grebogi, and H. Koçak, Phys. Rev. E 48 1676 (1993)] in a driven nonlinear diode circuit is presented. A geometric model describing antimonotonicity in mathematical models of dynamical systems is given. The model for the nonlinear diode circuit is presented, and it is shown that the behaviour of the model agrees very well with the behaviour of the physical circuit.

CONSTRUCTION AND USE OF A WAVEFRONT SENSOR FOR ADAPTIVE OPTICS

Wesley A. Bernard
Department of Electro-Optical Engineering
University of Dayton

Abstract

The effects of atmospheric turbulence on the propagation of light, and information that may be encoded on this light, were studied. A Hartmann Wavefront sensor was constructed to sample incoming light using a CCD camera and an array of small lenslets. This enabled the creation of phase screens to express how light from a distant source had been altered by variations in the refractive index of the intervening medium. Experimental data was taken, and is currently being processed. Deformable mirrors may eventually be used in the optical path of the light to conjugate out the effects of turbulence, leaving the signal in its original state. This is the goal of adaptive optics.

Abstract:

Advances in Virtual Manufacturing (VM) are needed to help industry deal with the changing environment of lower production, higher variety, and decreasing budgets. These advances rely heavily on the integration of a number of technologies referred to as VM tools. One step toward full integration of these tools is to accurately and completely model the current, and proposed, processes involved in manufacturing which I have made some strides in accomplishing.

This paper attempts to summarize the activities performed by myself during the summer of 1995 while at Wright-Patterson Air Force Base. Although impossible to capture all I have learned, I have tried to capture some major points of interest and observation. Much of the work performed during the summer was done in conjunction with the modification of an F-15 part being redesigned at McDonnell Douglas Corporation using VM tools. Engineers and other personnel at McDonnell Douglas Corporation were very helpful in providing me with a better understanding of how things are manufacturing in their Company.

A STUDY OF PULSED LASER DEPOSITION OF SILICON CARBIDE THIN FILMS

Ronald Birkhahn
Graduate Student Associate
Department of Materials Science

Andrew J. Steckl
Professor
Department of Electrical and Computer Engineering

ABSTRACT

We investigated the validity of using pulsed laser deposition (PLD) to deposit single crystal epitaxial SiC films during the Summer Research Program at Wright Patterson Air Force Base. After modification of the substrate stage for heating capability, SiC was pulsed-laser-deposited onto (001) Si, SiC on (111) Si, and SiC substrates. X-ray diffraction (XRD) showed that the crystallinity of the deposited SiC film improved with increasing substrate temperature and reduced laser repetition rate, but remained polycrystalline overall. However, discrepancies between temperature characterization techniques prevented us from accurately determining the substrate temperature.

Finite Element Modeling of Jet Fan Engine Blades

Jason Blair
Graduate Student
Department of Mechanical and Materials Engineering
Wright State University

Abstract

Modeling of F100 jet engine third stage compressor fan blade was studied. A solid model of the fan blade was generated and its mode shapes and natural frequencies were determined. The model was processed using both MSC/PAL and MSC/NASTRAN for comparison. The results were in agreement to within 10%. A generic eight bladed hub assembly model was also constructed. It was created for use in the studying of component mode synthesis. This model was modified in three stages to fine tune the design.

A STUDY OF ENHANCEMENTS IN CRYOGENIC WASHOUT PROCESS

Leo Bresler
Graduate Student
Department of Chemical Engineering
Northwestern University

Abstract

Large rocket motor cryowashout process was studied. Although the process is similar to waterjet applications, the direct use of available models is not possible due to the nature of solid rocket propellant and large temperature difference. A number of enhancements can be implemented within the current installation design to improve the material removal rate and safety of the process. A series of tests should provide additional information needed for further optimization. Possible major design changes needed for overall optimization are also discussed.

SYNTHESIS OF NOVEL SECOND ORDER NONLINEAR OPTICAL MATERIALS

Lawrence L. Brott
Department of Materials Science and Engineering
University of Cincinnati

ABSTRACT

Synthesis of second order nonlinear optical (NLO) polymers represents an exciting field with the resulting chromophore containing materials being used in such devices as frequency doublers or electro-optical computers. In this research, a novel NLO chromophore is developed by incorporating a fluorene molecule in its backbone with thiophene and pyridine end groups that act as electron donating and withdrawing groups respectively. Long alkyl chains are attached to the C-9 carbon on the fluorene backbone to aid in the chromophore's solubility in the host polymer.

AN INVESTIGATION OF STATISTICAL TECHNIQUES FOR FINDING RELATIONSHIPS BETWEEN PARAMETERS IN A SEMICONDUCTOR PROCESS DATA COLLECTION

Kember L. Brown
Graduate Student
Department of Electrical Engineering and Applied Science
Oregon Graduate Institute

Abstract

The goal of this investigation is to study statistical techniques that can be used to find relationships among input and output data vectors from a semiconductor process data collection. Techniques explored include regression analysis, principle component analysis, and analysis of variance.

A Methodology for Assessing Experimental Uncertainties in Curvefits with Application to Compressor Map Characteristics

Kendall K. Brown
Graduate Research Assistant
Department of Mechanical and Aerospace Engineering
University of Alabama in Huntsville

Abstract

In this report a methodology is presented to assess the uncertainties associated with curvefits and is demonstrated with an application to turbine engine compressor map characteristics.. The approach presented is a continuation of work to develop a methodology to properly account for these uncertainties. It is based upon applying uncertainty propagation techniques to the linear regression analysis equations used for curvefits. It assesses the uncertainty when precision, systematic, and correlated systematic uncertainties are present. This technique can also be applied when the X and Y variables are functional relations of test data, often referred to as data reduction equations. The methodology is presented for first order curvefits and is extended to the general n^{th} order curvefit. The effectiveness of this methodology was analyzed using Monte Carlo-type simulations. The conclusion of this report is that this methodology for assessing the uncertainty in curvefits is acceptable for 1^{st} order linear regressions. The extension of the methodology to n^{th} order polynomial curvefits requires further research.

A STUDY OF THE MONTE CARLO METHOD

Jamylle L. Carter
Graduate Student
Department of Mathematics
University of California, Los Angeles

Abstract

The Monte Carlo method was studied and applied to the integral and the heat conduction equation. For the integral, the error of the Monte Carlo method was estimated and a precise mathematical explanation given for its use. Results were satisfactory for the integral yet intriguing for the heat equation. The Monte Carlo heat equation solution, derived from a finite-difference equation, suggests either the presence of another mechanism in the physical experiment, i.e., that the original analytical equation may contain error, or the need for greater discretization in the Monte Carlo code.

TORSIONAL SPLIT-HOPKINSON BAR EXPERIMENTS ON OFHC COPPER, AL 2024 AND FILLER-E

Richard J. Caspar
Graduate Research Assistant
Department of Aerospace and Mechanical Engineering
University of Notre Dame

Abstract

The solid explosive simulant, Filler-E, was successfully tested with a torsional split-Hopkinson bar. In order to achieve this result, modifications were made in the design of the torsional Hopkinson bar at Eglin Air Force Base, Florida, in the Advanced Warheads Evaluation Facility (AWEF) to make it operable. Tests were then performed on Oxygen-Free-High-Conductivity (OFHC) Copper and Aluminum 2024-T6 to validate the accuracy of the Hopkinson bar. The ultimate stress for OFHC Copper at a strain rate of 700 s^{-1} was found to be 220 MPa, which closely compares to Weerasooriya's results (1990), which give an ultimate stress of 190 MPa for a strain rate of 800 s^{-1}. The ultimate and yield stresses for Al 2024 at a strain rate of 1100 s^{-1} were found to be 200 MPa and 310 MPa, respectively, which are within reason when compared to the quasi-static values of 230 MPa and 290 MPa, respectively. A specimen was designed for Filler-E, which resulted in values of yield stress and ultimate stress, for a strain rate of 600 s^{-1}, to be 3 MPa and 3.5 MPa, respectively. Important information was gained as to the testing of explosive simulants with the torsional Hopkinson bar, which will prove to be instrumental in the design of a Hopkinson bar at the University of Notre Dame.

Enhanced Graphical User Interface for Imagery Toolkit and Its Extensions

Shy-Shyan Chen
Ph.D. Candidate
Department of Computer and Information Science
New Jersey Institute of Technology

Abstract

For effective exploitation of digital imagery data, there is a great need for collecting image processing routines which can easily and effectively used on a variety of data. An Imagery Exploitation 2000 (IE2000) imagery toolkit, initially developed by professors Robert Stevenson and Robert Snapp, have been upgraded to SUN workstation runing Solaris. The graphical user interface, preliminarily developed by Audrey Copperwheat, have extensively been integrated for all the functions of imagery toolkit. It includes the ofter-used techniques in image processing such as image manipulation, enhancement, feture extraction, filtering, degradation, and statistics. We have also included some useful image processing rountines such as morphological operations and image segmentation.

THE DESIGN OF A PC-BASED DATA ACQUISITION AND CONTROL ENVIRONMENT FOR USE IN A DSP-BASED ACTIVE DYNAMOMETER

James L. Cifarelli
Research Assistant
Department of Electrical and Computer Engineering
Clarkson University

Abstract

This paper describes the software environment designed for implementing a DSP-based (Digital Signal Processor) active dynamometer. Such a dynamometer can dynamically change the load projected onto machines under test. With today's thrust into electrically mobilized vehicles and devices, a computer based active system can project the same dynamic loads on machines as would be found in the field. Our goal is to design and build a window's based graphical user interface (GUI) and subsystem for the control and data acquisition of this active dynamometer.

A STUDY OF SUPER CAPACITOR APPLICATIONS

Robert C. Cravens, II
Department of Electrical Engineering
Ohio University
Athens, OH 45701

Abstract

The feasibility of the use of a super capacitor and DC/DC converter to improve the regulation of the bus voltage of an aircraft was studied. A boost DC/DC converter was used to transfer the energy from the capacitor to the dc bus voltage level. A buck DC/DC converter was used to transfer energy from the dc bus to the capacitor. Experimental results indicate that a super capacitor and DC/DC converter can be used to improve the regulation of the bus voltage of distributed power systems.

MOOD CHANGE: DOES IT AFFECT PSYCHOMOTOR PERFORMANCE?

Thomas L. Dallam
Doctoral Student
Department of Psychology
Virginia Polytechnic Institute and State University

Abstract

The purpose of this study was to investigate the effects of mood on psychomotor performance. Subjects were administered the same psychomotor test battery on two different days. Subjects also filled out a mood survey in the morning and afternoon on each of these days. Positive mood was hypothesized to be positively related to psychomotor performance, and negative mood was hypothesized to be negatively related to psychomotor performance. A number of statistical analyses were performed (e.g., hierarchical regression, simple linear regression, MANOVA), but in all, positive and negative mood did not have a significant relationship with psychomotor performance. A number of explanations are offered for these findings.

MODEL-BASED SYSTEM DEVELOPMENT FOR AEROSPACE TESTING INSTRUMENTATION

Theodore A. Bapty
Research Assistant Professor

James R. Davis
Graduate Student
Department of Electrical and Computer Engineering

Abstract

The complexity of modern aerospace systems requires significant amounts of testing to ensure correct operation and cost effective development. Ground testing enables extremely accurate control over the external conditions along with the ability to acquire a large number of measurements of internal engine structures.

Analysis and verification of turbine engine testing data is a computationally intensive, dynamic process. The combination of high bandwidths, large numbers of channels, and constantly changing processing requirements place many demands on an instrumentation and data analysis system. The complexity of building and managing the data systems necessary for the analysis/verification requirement is a difficult task, considering the real-time, parallel, and reactive characteristics of these systems.

Several systems have been developed at AEDC using **Model-Based** system synthesis techniques. This report describes three systems in various stages of development. The Computer Assisted Dynamic Data Acquisition and Monitoring System(CADDMAS), developed in conjunction with Arnold Engineering Development Center, has been in operation for two years in support of simulated altitude turbine engine stress testing. The system uses parallel processing to sustain over 800 million floating point operations per second(MFLOPS) producing on-line data analysis plots, delivering true supercomputer performance. Various improvements to the system have been implemented during the program.

DEVELOPMENT AND EVALUATION OF A NUMERICAL MODEL FOR ANALYSIS OF AERODYNAMIC ICING SIMULATIONS

Brian C. DeAngelis
Graduate Assistant
Department of Aeronautical and Astronautical Engineering
University of Illinois at Urbana-Champaign (UIUC)
Urbana, IL 61801-2997

Abstract

The objective of this research was to further develop methodology previously designed for the numerical modeling of wind tunnel icing simulations. The KIVA-II code had been modified for efficiency by accounting for assumptions noted for these types of flows. Using this code, a reduced vapor model was tested and implemented at significant computational cost savings. It was determined that vapor pressure in these types of flows has negligible computational effect on the evaporation of water droplets, leading to the subsequent removal of all vapor calculations. An acceleration model was also tested to improve calculation speed, at a mild loss in accuracy. Due to the level of accuracy required from these computations, however, the acceleration scheme could not be implemented. The methodology was validated using experimental data generated for a variety of particle types experiencing dispersion in a decaying turbulence channel flow. Validation of another data set generated for an icing-type spray and flow field is currently progressing. Finally, a unified icing simulation code named K-ICE was designed based on results from these studies.

PREDICTION OF COOLING WALL TEMPERATURES USING THE NPARC CODE

David Dembicki
Graduate Research Assistant
Department of Mechanical Engineering
University of Tennessee Space Institute

Abstract

Research was conducted in the area of predicting thermal effects within a F100 class turbine engine afterburning section using a Navier-Stokes flow solver set up for a 2D, axi-symmetric case. Particular attention was paid to the simulation of the engine's flame holders and porous cooling liner. The complex flame holder geometry was portrayed as an equivalent two-dimensional blockage area. The liner was modeled as both a porous slip wall and as a solid no-slip wall. While the various shapes used for the flame holders appeared to have some influence on the cooling liner temperatures, the type of wall used for the liner had a major effect on the final wall temperatures. The porous slip wall produced unfavorable results; however, the no-slip, solid wall yielded results similar to the experimental data. Flame holder location also played a significant part in achieving the correct liner wall temperatures.

September, 1995

Analysis To Determine The Quality Factor Of A Celestron-8 Telescope

Ronald R. DeLyser
Assistant Professor of Electrical Engineering
Peyman Ensaf
Graduate Student
Department of Engineering
University of Denver

Abstract

Due to geometrical similarities between the Celestron-8 telescope and some of the space telescopes, calculating near fields within the Celestron-8 telescope was important for survivability/vulnerability assessments of space telescopes. In this analysis our goal is to use the software package CARLOS-3D [2], to calculate the near fields within the cavity of the Celestron-8 telescope and compare the results obtained using two different discretizations. This report provides some of the formulations and approaches used for this type of assessment along with the errors in results and some suggested improvements.

ELECTROPHYSIOLOGICAL, BEHAVIORAL, AND SUBJECTIVE INDEXES OF WORKLOAD WHEN PERFORMING MULTIPLE TASKS: MANIPULATIONS OF TASK DIFFICULTY AND TRAINING

Lisa R. Fournier
Graduate Student
Department of Psychology
University of Illinois

Abstract

This study examines the effectiveness of using brain activity such as alpha rhythm, event-related desynchronization (ERD) as a measure of mental workload in a "real world" task. Subjects performed multiple tasks that were similar to those encountered by a pilot inside of an airplane cockpit. These tasks were interactive and included monitoring the path of the airplane (tracking), verbal communications, gauge display changes, and light display changes. We were interested in whether the alpha ERD can successfully measure workload as well as discriminate between novice and expert performance obtained through training. We expect alpha ERD duration to increase and alpha amplitude to decrease under conditions of high mental workload. Also, we expect differences in alpha ERD duration and amplitude across the various levels of workload difficulty (low, medium, and high) to be reduced after training. Additional measures, including heart rate, respiration, behavioral performance, and subjective workload measures were recorded to determine how well alpha ERD duration and amplitude correlates with these workload measures. If alpha ERD proves to be a successful index of workload, we can use this measure to determine what characteristics in operator displays (e. g., cockpit displays) increase or decrease operator workload.

TECHNIQUES TO SUPPRESS A NEAR FIELD SCATTERER IN DIRECTION FINDING

Edward Michael Friel
Graduate Student
Department of Electrical Engineering
University of Dayton

Abstract

It is often necessary to estimate the angles of arrival of incident signals with a small angular separation. This estimate may be corrupted by an object in the near field of the antenna array that scatters energy toward the array. In this report, two techniques are presented to suppress the effects of a near field scatterer. The first technique suppresses the interference from the scatterer by modifying the array configuration such that a null is placed at the point of the scatterer. This technique successfully suppresses the scatterer and only reduces the number of effective antenna elements by one. The disadvantage of this technique is that it requires knowing the location of the scatterer. The second technique attempts to estimate the angles of arrival by first decorrelating the incident signals from the scattered signals by using spatial smoothing. It is shown in this report that standard spatial smoothing technique can be applied even for signals with non-planar wavefronts such as those from a near field scatterer. The angles of arrival can then be accurately estimated although a small spurious peak now occurs in the spatial spectrum. The advantage of this technique is that it does not require knowing the location of the scatterer. The disadvantage is that the number of elements in the antenna array must be twice the number of decorrelated signals or four times the number of uncorrelated incident plane waves.

A NUMERICAL INVESTIGATION OF TWO-PHASE DETONATION

Keith A. Gonthier
Ph.D. Candidate
Department of Aerospace and Mechanical Engineering
University of Notre Dame

Abstract

A two-phase model based upon principles of continuum mixture theory is numerically solved to predict the evolution of detonation in a granulated reactive material. Shock to detonation transition (SDT) is considered in which combustion is initiated by the motion of a piston. In particular, this study demonstrates the existence of an SDT path which gives rise to a steady two-phase Chapman-Jouguet (CJ) detonation structure consisting of a shocked gas and unshocked solid; this structure has previously been independently predicted by a strictly steady-state theory. The numerical algorithm used to solve the model equations is based upon Godunov's method and incorporates an approximate Riemann solver which is constructed to handle non-ideal equations of state. Comparisons are made between numerical predictions and known theoretical results for 1) an inert two-phase shock tube problem, 2) an inert compaction wave structure, and 3) a reactive two-phase detonation structure; in all cases, good agreement exists.

DEVELOPMENT OF A GAS UPTAKE TECHNIQUE TO DETERMINE KINETIC CONSTANTS FOR METABOLISM OF INHALED TRICHLOROETHYLENE BY MALE B6C3F1 MICE

Marc S. Greenberg
Graduate Student
Biomedical Sciences Ph.D. Program
Department of Pharmacology & Toxicology
Wright State University

Abstract

Methods were developed to investigate the uptake of the chlorinated hydrocarbon trichloroethylene (TCE) in small numbers of B6C3F1 mice. A gas uptake system was constructed in order to measure the removal of the compound from a recirculating atmosphere by mice exposed to 100, 300, 600, 1000 and 5000 ppm TCE in air. These data will be used in the development of a physiologically-based pharmacokinetic (PB-PK) model to describe the uptake of TCE and its metabolism to active metabolites in mice. Metabolic rate constants needed for the PB-PK will be estimated by a computer simulation approach using experimental gas uptake results as input data. Following a calibration period, it was determined that the gas uptake system is ready for use since it contains no leaks, a linear standard curve over a broad range of TCE concentrations (100-7000 ppm) has been constructed and the loss rate from an empty chamber remains constant over this range of concentrations. Simulations of planned exposure concentrations and preliminary experiments with mice exposed to 1000 ppm TCE indicate that the maximum rate of metabolism, V_{maxc}, is between 4.0 and 32.7 $mg \cdot kg^{-1} \cdot h^{-1}$ for male B6C3F1 mice. Completion of the study at all TCE concentrations described in the experimental design will give an accurate estimate of this metabolic constant. The implications of obtaining an accurate value for V_{maxc} over a broad range of TCE concentrations to the PB-PK modeling effort are addressed in the discussion.

THE OCCURRENCE OF APOPTOSIS FOLLOWING ACUTE EXPOSURE TO TRICHLOROETHYLENE IN THE LIVERS OF 12-WEEK OLD MALE B6C3F1 MICE

Matthew C.Grothaus
Graduate Student
Department of Pathology
The Medical College of Ohio

Abstract

Trichloroethylene (TCE) is a degreasing solvent that has been widely used by the U.S. Air Force which has resulted in groundwater contamination at and around some Air Force bases (4). TCE has been shown to be a liver carcinogen in mice (6,7). The potential for carcinogenicity of TCE in humans is largely unknown. Understanding the mechanism of liver tumorigenicity in mice is critical in assessing the cancer health risk of TCE-exposure in humans. Cell proliferation is thought to be an important early event in chemically-induced carcinogenicity. Apoptosis, a physiological form of cell death that acts as a counterpart to mitosis, is thought to function in concert with cell proliferation to maintain tissue homeostasis. A decreased incidence of apoptosis would disrupt tissue homeostasis thereby favoring cell proliferation. This has been proposed as one mechanism of clonal expansion of pre-neoplastic and neoplastic cells (5). The purposes of this study, therefore, were to determine the effects that exposure to trichloroethylene has on the incidence of apoptosis in the livers of 12-week old male B6C3F1 mice, and investigate the relationship that apoptosis has to cell proliferation that is known to occur at early time points following acute exposure to this chemical. Twelve-week old B6C3F1 mice were administered TCE at dose levels of 1200 mg/kg/day and tissue samples were harvested at days 2,10,14 and 28. *In situ* end labeling was used to evaluate apoptosis. Results were not significant suggesting that there are other mechanisms playing a more significant role in the formation of proliferative lesions that are present following continuous exposure to TCE.

REDUCTIVE DEGRADATION AND SORPTION OF *cis*- AND *trans*-1,2-DICHLOROETHENE IN A METALLIC IRON/WATER SYSTEM

Richelle M. Allen-King, Assistant Professor and
Richard M. Halket, Graduate Student
Department of Geology
Washington State University
Pullman, WA 99164-2812

ABSTRACT

Reductive transformation kinetic and sorption coefficients were determined for both *cis*- and *trans*-1,2-dichloroethene (DCE) in batch systems with zero-valent iron and water. Chloride was produced by the transformation reaction and chlorine mass balances for the batch systems were 80 to 85%. The transformation reaction was not first order in solution concentration or total system concentration for either of the two isomers. Measured reaction rate coefficients (λ_a) and orders (N_a) for the two compounds in experiments with initial concentrations of approximately 1850 nmol/ml were: 0.17 [nmol/hr]/[(nmol/ml)^{N_a}] (ln λ_a= -1.79) and 0.00023 [nmol/hr]/[(nmol/ml)^{N_a}] (ln λ_a= -8.37) with reaction orders 1.22 and 1.77 for *trans*-1,2-DCE and *cis*-1,2-DCE, respectively. Sorption equilibrium was apparently attained within 1.1 hr. The form of sorption could be adequately described by Freundlich-type isotherms for both compounds over the concentration range measured. The magnitude of sorption was greater for *trans*-1,2-DCE than for the more soluble *cis*-1,2-DCE. The distribution of organic products produced by the two isomers indicates some divergence in reaction pathways. While both compounds produced large proportions of ethene and ethane, transformation of *cis-1,2*-DCE resulted in significantly greater production of vinyl chloride than did *trans*-1,2-DCE.

COMPARATIVE EFFECTS OF DYNAMIC AND STATIC STRENGTH TRAINING ON $+G_Z$ TOLERANCE

Christopher M. Hearon
Instructor
Department of Kinesiology
Louisiana State University

Abstract

The comparative effectiveness of generalized dynamic resistance strength training and specific static resistance strength training in enhancing relaxed, gradual onset rate (GOR) $+G_Z$ tolerance and +4.5 to + 7.0 G_Z simulated air combat maneuver endurance is the focus of the present investigation. Because of the muscular efforts demanded of individuals during repeated performance of the AGSM during high +Gz conditions, physically untrained individuals will fatigue earlier than their physically trained counterparts. Thus, the protective effect of general strength training programs on $+G_Z$ endurance has indicated enhancement of $+G_Z$ endurance in strength-trained subjects. Additionally, results by the Russians indicated that static force generated by a pilot during a progressive test of sustained, static leg press was highly predictive of $+G_Z$ tolerance. Thus, it was the purpose of the present investigation to compare these training regimes as to serve as an important step in responding to the flying community's request for a physical training program which enhances $+G_Z$ endurance and also reduces aircrew training time involvement. The present investigation has not been completed, and is ongoing, thus no final results are reported at present.

Winn Hong
Graduate Research
Department of Mechanical and Aerospace Engineering:
Center for Micro Systems

Abstract

The feasibility of using micro-electro-mechanical system (MEMs) devices for possible space applications is investigated. Specifically, the Analog Device's ADXL-05 and ADXL-02 tri-axis micro-accelerometer units will be used in hope of monitoring the changes in satellite acceleration due to tumbling, release shock, and orbiting. Ground tests using the shaker table for characterization before and after the total dose radiation affects in a Cesium source irradiation chamber is also performed. Temperature affects and long term dc drift are also investigated.

Abstract

The expression of the 72-kDa family of heat shock proteins (hsp70) has been studied in a number of tissues in response to exercise. However, hsp70 expression has not been investigated in the brain following exercise. The purpose of this study was to: 1) determine if hsp70 was expressed in the brain in response to acute treadmill (TM) exercise in rats under thermal neutral conditions (24 °C); 2) determine the pattern of hsp70 expression in the brain following TM exercise in a hot environment (34 °C); and 3) compare the pattern of hsp 70 expression in the brain between these groups as well as to sedentary rats exposed to environmental conditions designed to mimic the increase in brain temperature experienced by the two exercising groups. Male Sprague-Dawley rats underwent stereotaxic surgery to implant a guide cannula designed to accommodate a temperature probe used to measure hypothalamic temperature ($T_{hyp.}$). Following recovery from surgery, rats were familiarized with TM exercise (13 m/min, 0% grade, 10 min, 3 sessions minimum). Rats were then randomly assigned to one of four treatment groups: 1) neutral/sedentary (NSed); 2) hot/sedentary (HSed); 3) neutral/exercise (NEx); and 4) hot/exercise (HEx). The exercise groups were subjected to 60 minutes of running (21 m/min, 8% grade) at an environmental temperature of 24 °C or 34 °C on a modified TM equipped with environmental temperature controls. HSed rats were placed on the TM (but not run), the environmental temperature as adjusted during testing to mimic the thermal profiles observed in the exercise group. Home cage control rats (Con) were also investigated. Rats were euthanized 6 hr after treatment. Immunohistochemical stained sections were examined using light microscopy and hsp70 expression was quantitated by determining the concentration of positively stained cells in five different brain regions. There was no significant difference between in hsp70 expression among Con, NSed, and NEx groups in any brain region examined. This was in spite of the fact that significant elevations in $T_{hyp.}$ occurred in response to HSed and NEx (mean peak $T_{hyp.}$. = 40.5 ± 0.5 °C). In contrast, the cerebellum of the HEx rats displayed a robust expression of hsp70. From these results it was concluded that hsp70 does not play a role during acute exercise under thermal neutral conditions.

TECHNICAL SOFTWARE DOCUMENTATION FOR PRFECT

Ann M. Kaul
PhD Student
Department of Mathematics and Statistics
University of New Mexico

Abstract

The Predictive Radio Frequency Effects Coupling Tool (PRFECT) is a computer model currently being developed that will simulate the effects of a ground-based radio frequency (RF) source engaging a space system. PRFECT will provide an estimate of the probability of failure, degradation or upset of a receiver's performance by an RF source. One of the necessary components for validation and verification of a computer model such as PRFECT is accurate documentation of the processes which the model simulates. User's Manual for PRFECT - Volume II presents the statistical methodology used in the model.

ENVIRONMENTAL PLANNING METHODOLOGY

Jan S. Lach
Graduate Student
Department of Engineering Management

Abstract

The purpose of this research was to develop a methodology for building an environmental plan that can be used by management to identify, select, and prioritize environmental projects. The research procedure was to 1) examine the methods recommended by management analysts for developing plans, 2) examine the environmental planning experiences of government and industry, 3) examine this process as it is practiced on an installation, and 4) combine this information into a practical methodology that would provide a coherent, proactive plan for achieving the best value from environmental compliance projects. A functional plan that is structured to be consistent with the "pillars" or categories of Air Force environmental management and with the existing management information system is developed. The methodology uses a structured decision making process to identify environmental improvement projects and is developed as a five step procedure: 1) develop a statement of need; 2) appraise project alternatives; 3) perform a weighted strength assessment; 4) prioritize projects within their pillar; and 5) prioritize projects overall.

DEVELOPMENT OF A LIQUID MERCURY OPTICAL SCINTILLATOR (LMOS)

Roger T. Lindquist
Electro-Optics Engineer
University of Dayton

ABSTRACT

Laboratory simulation of atmospheric laser scintillation is accomplished through a Liquid Mercury Optical Scintillator (LMOS). Spatial irradiance variations in the reflected beam exhibit probability distributions matching atmospheric ln-normal statistics. A large range of variance levels has been observed, indicating LMOS can simulate a wide range of turbulent atmospheric conditions. LMOS uses a vibrating liquid mercury design that is virtually wavelength independent and statistically controllable in real time. The invention has immediate applications in the laboratory evaluation of optical receivers and their performance under specific scintillation conditions.

LMOS uses the high reflectivity of the mercury surface to spatially modulate laser light. This modulated light mimics the effects observed when a laser beam propagates over a long path of turbulent atmosphere. Energy is coupled into the liquid mercury through an electro-magnetic solenoid and a magnet floating on the mercury's surface. This excites turbulent vibrations in the partially bounded mercury, creating angular distortion areas that redistribute energy in the reflected beam. The statistics of the energy redistribution depend on the applied energy spectrum, light beam angle of incidence, equivalent pathlength working distance, as well as the shape and texture of the containment vessel boundaries. Significant progress has been made in the examining these and other parameters of LMOS. Computer control of LMOS has been accomplished through Analog to Digital, Digital to Analog boards, and RS232 communications controlled by specialized software. LMOS prototype #3, has already been used in the developmental testing of an actual Laser Warning Receiver.

AUTOMATED CREATION OF WEB FORMS FOR CREST DATA LIBRARY

Brian D. Lubinsky
Graduate Student
Department of Electrical Engineering
University of Cincinnati

Abstract

A method of automatically creating web forms (html files) through the use of a GUI (graphical user interface) was created. Tcl/tk programming language was used. The GUI prompts the user for a variety of information, and after completing the data entry, the user may simply click on a button icon to create an html document. The user may then view this or any other form through a web browser or may choose to simply view the text file through an editor. This method provides a quick and easy way of creating web documents, regardless of previous internet or html experience. Help windows are also a prominent feature of the program.

The Feasibility of Using Microwave/Electron Beams for Hypersonic Flow Ionization

John D.H. Mai

Doctoral Student

Mechanical, Aerospace and Nuclear Engineering Department

University of California, Los Angeles

Abstract

This paper attempts to give a preliminary overview of the physics which occurs during the ionization of a fluid and how to ionize flow in the ARL 20 inch Hypersonic Wind Tunnel. The key point of interest is the fact that electron-ion and ion-ion collisions induce the majority of the ionization processes. Microwave ionization essentially is a secondary effect and only has an effect on the ionization process due to the fact it facilitates electron-ion collisions. The Boltzmann equation is presented, but no attempt is made to explicitly solve it for the boundary and initial gonditions in the 20 in. tunnel. Instead empirical correlations based on basic research done by others is applied to this situation. A reasonable method to induce microwave ionization is to generate an electric field of approximately 22.5 kV/cm to generate microwaves of 131.8 GHz frequency that will lead to air breakdown. Another method is to use a 1.72 cm diameter electron beam, with an electron temperature above 16 eV and an initial density of at least 10^{19} electrons per m^3, and raster scan it across the tunnel test section, cross sectional area at 343 kHz in order to fully ionize the 10 inch usable core for the entire 40 inch length of the test section.

A note must be made about the various discrepancies presented in this paper. First many of the empirical correlations used in this paper did not have adequate documentation. The problems were usually that certain parameters were not well defined or that there were slight variations in parameter definitions from one paper to the next, so errors initially appeared when comparing results from one paper to the next. (such as in the case of collisional cross sectional area and ionization frequency). Additionally, many of the papers detailed the quantum mechanical aspects of ionization, which means the data is referenced per electron. Therefore, scaling errors probably appeared as I multiplied these values so that the units would be consistent with the macroscopic correlations presented by other authors. Finally, no attempt was made to compensate for real gas effects such as electron quenching, electron scattering, and multiple ionizations of a single molecule or molecular dissociation due to heating.

WHOLE-BODY CENTER OF GRAVITY AND MOMENTS OF INERTIA STUDY

M. Virginia Marsh
Graduate Teaching/Research Assistant
Department of Engineering Science and Mechanics
The University of Alabama

Abstract

The primary objective of this effort was to conduct precise center of gravity and inertial property measurements on a selected pool of subjects to provide an independent accuracy assessment of the Wright Laboratory Center of Gravity and Inertia Meter (CGIM). Ejection safety is one of the most critical issues for accommodating the Joint Primary Aircraft Training System extended pilot population. Occupant mass, center of gravity (CG,) and mass distribution have a direct effect on ejection accelerations and forces, seat stability and control, harness fit, parachute opening shock, and spinal injury potential. Together, these variables are part of the seat's design limits which could lead to pitch stabilization problems and limb flail. The procedure to measure the whole-body CG and mass moments of inertia (MOI) of human subjects consisted of measuring the properties of a test subject secured within a lightweight chair and frame to provide the properties of the test subject alone. A scale and moment table were used to calculate the CG, a Space Electronics Mass Properties Instrument (MPI) was used to measure the MOI, and a computer and associated software were used to perform all necessary calculations. This system was used to determine CG and MOI data for the chair alone as well as for the composite system containing the chair and a test subject such as manikins, calibration slugs, or a human. Since the error calculations were within an acceptable tolerance, approval was sought to begin scheduling, preparation for, and actual testing of human subjects.

The Behavior of a Free Beam with Piezoelectric Vibration Control System

Roy E. Martin III
Masters Graduate Student
Department of Mechanical Engineering

Abstract

The focus of the summer research sponsored by the Air Force Office of Scientific Research is the application of piezoelectric ceramic thin sheets as actuators and sensors as part of an active vibration control (AVC) system. The aim of the AVC system is to increase the decay rate of a vibrating free beam with concentrated masses. Continuous beam theory and a model developed by Crawley-de Luis predict the frequencies and deflected shapes of the beam and the decay rate of the beam under feedback controls, respectively. The predicted feedback controls increase the decay rate of the freely vibrating beam by one to two orders of magnitude. An experiment was designed and built to test the theory, but the development of an analog control circuit was delayed due to difficulties. The future work based on this summer research, besides expanding theoretical models, is to develop a control system, perhaps digital, to confirm the predicted decay rate.

Design of a Fuzzy Logic Controller

Vikas Mehrotra
Graduate Student
Department of Electrical Engineering
The Ohio State University
Massachusetts Institute of Technology

Abstract

A fuzzy logic controller is designed using the Comdisco Signal Processing Worksystem (SPW) software package developed by the Alta Group of Cadence Design Systems, Inc. The design is done using block diagram descriptions of the various components with mathematical and logic functions. Each entity in the design is linked via a heirarchical structure, which is used as part of the complete design. The hardware description language code is generated for each entity, as well as for the entire fuzzy controller. This code is then used with Synopsys to synthesize and optimize the circuit, which will be used in the fabrication of an integrated circuit chip.

The fuzzy controller presented here takes two input variables, error and change of error, and performs the fuzzification using seven triangular membership functions. The fuzzy set centers may be adjusted by the user for both the inputs and the output, but the rule base is fixed for each design. The controller has been successfully simulated in Comdisco for selected inputs. It is first designed with floating point blocks and then converted to fixed point for hardware description language code generation.

MISSILE AUTOPILOT DESIGN BASED ON A UNIFIED SPECTRAL THEORY FOR LINEAR TIME-VARYING SYSTEMS

Michael C. Mickle
Candidate for Doctor of Philosophy
Department of Electrical and Computer Engineering
Louisiana State University

Abstract

This report presents design and simulation case studies of a missile autopilot for angle of attack and nominal acceleration tracking using a recently developed Extended-Mean Assignment (EMA) control technique for linear time-varying (LTV) systems. The EMA control technique is based on a new eigenvalue concept, called SD-eigenvalue, for LTV systems. Closed-loop stability is achieved by the assignment of the extended-mean of these time-varying SD-eigenvalues to the left-half complex plane in a way similar to the eigenvalue (pole) assignment technique for linear time invariant (LTI) systems. Salient features of the tracking controller include: (i) good tracking performance for arbitrary trajectories without any scheduling of the constant design parameters throughout the entire operating range of the Mach, (ii) implementation of the inverse pitch dynamics using a static neural network, (iii) time-varying EMA control gains to improve tracking performance, and (vi) a time-varying bandwidth command shaping filter that effectively reduces the actuator rate while maintaining good tracking response for both smooth and abrupt trajectories. Although the autopilot was designed only for nominal aerodynamic coefficients and constant trajectories, excellent performance was verified for $\pm$ 50% variations in the aerodynamic coefficients, and for arbitrary command trajectories.

FATIGUE CRACK GROWTH THROUGH EXFOLIATION CORROSION IN ALUMINUM ALLOY 7075-T651

Thomas B. Mills
Graduate Student
Department of Mechanical Engineering
University of Utah

Clare A. Paul
Wright Laboratory
Fatigue, Fracture, & Reliability Section

ABSTRACT

Exfoliation corrosion is a potentially severe form of corrosion that frequently affects high-strength aluminum, particularly 2xxx- and 7xxx-series alloys. Exfoliation degrades components such as sheets, plates, and extrusions that have highly elongated grain structures. This form of corrosion appears as a flaky lifting of the surface, but it can also attack a material sub-surface, such as within fastener holes, and may not be immediately detectable. The problem of exfoliation corrosion in high-strength aluminum alloys has been traced to the presence of copper and zinc, which are both primary strengthening elements. Copper also has been blamed on increased susceptibility to pitting and stress corrosion cracking in these alloys.

While several methods have been developed over the last few decades to evaluate the susceptibility of high-strength aluminum alloys to exfoliation corrosion, few attempts have been made to investigate the effects of this form of corrosion on the fatigue performance of these materials. Therefore, a preliminary study was conducted to determine the effects of exfoliation corrosion on the fatigue response of 7075-T651 aluminum alloy plate.

Fatigue crack growth experiments were conducted in both dry air and humid air environments on specimens exhibiting either no corrosion damage or exfoliation damage approximately 0.008 inch in depth on one surface. The fatigue lives of the corroded specimens were as much as three times shorter than their uncorroded counterparts. The increase in crack growth rates evident in the corroded specimens during the dry air series of experiments were statistically significant below 7 ksi $\sqrt{in}$. A similar difference seemed to exist in the wet air conditions, but no statistical evaluation was conducted since time precluded the completion of more than one corroded/humid air test.

The data suggest that the acceleration in crack growth rate caused by the corrosion can not be solely explained by the loss in thickness. It is suspected, as others have proposed, that embrittlement in the material may be responsible for part of the growth rate difference. However, future experiments coupled with extensive fractography will be necessary to clarify this issue.

MIRTIS: A MODEL-INTEGRATED
REAL-TIME IMAGE PROCESSING SYSTEM

Michael S. Moore
PhD. Candidate
Department of Electrical Engineering
Vanderbilt University

Abstract

MIRTIS (Model Integrated Real-Time Image processing System) is an environment which employs model-based synthesis techniques to generate real-time image processing applications. MIRTIS is capable of creating very high performance implementations of a large class of image processing computations. It automatically data parallelizes the computations using the split-and-merge processing model and executes them on a parallel hardware architecture, a network of C40 DSPs. During the 1995 RDL/AFOSF Graduate Student Summer Research Program, improvements were made to the MIRTIS system which will enable it to be used in tests at AEDC in the near future.

1 Introduction

1.1 Motivation

Non-dedicated image processing applications users usually have to sacrifice algorithm implementation flexibility for real-time performance. Most existing off-the-shelf real-time systems use specialized hardware architectures to perform specific algorithms in real-time (eg. convolution). A draw-back of specialized hardware is that it cannot always be re-programmed with new or non-standard algorithms. Some imaging facilities, such as the one at Arnold Engineering Development Center (AEDC), need a system which can be rapidly programmed, configured, and scaled to solve a wide variety of problems.

AEDC provides technical support for aerospace tests which involve the largest and most technologically advanced flight simulation facilities in the world. Information extracted from video test data is often needed for analysis during and after the flight simulations. Since the fast availibility of this information can be quite critical to the success of the tests, the data must be processed as quickly as possible. In some cases, the processing must be done in real-time. The existing hardware solutions at AEDC (a Quantex QX-7 system, and various PC based imaging boards) do not always meet their needs because of limits in capability, reliability, and algorithmic flexibility.

Through the search for a replacement for AEDC's current real-time imaging systems, it has become evident that the real-time image processing equipment currently available "off the shelf" is

Laboratory Studies of Current Driven Plasma Processes with the Versatile Toroidal Facility (VTF)

Daniel T. Moriarty

Graduate Student

Nuclear Engineering Department

Massachusetts Institute of Technology

Cambridge, Massachusetts 02139

Abstract

The Versatile Toroidal Facility (VTF) has been constructed to create plasmas for wave-plasma interaction studies. Three plasma sources may be combined to produce various conditions. The plasma density gradients, field aligned currents, and other geometries and parameter ratios closely match the plasma conditions of the auroral and upper ionospheric regions. Current driven plasma waves have been observed in VTF and instability mechanisms are being studied. Spectral analysis reveals broadband emissions from below the ion cyclotron frequency, f_{ci}, to near the electron cyclotron frequency, f_{ce}. Waves with frequencies corresponding to the whistler and lower-hybrid ranges are consistent with the well known inverse Landau damping of energetic charged particles. Existing theory is modified to investigate current convective modes in VTF. Multi-point cross-correlation measurements have been performed to determine wave numbers of the excited modes and have qualitatively confirmed the modified theory. Comparison of VTF experiments with rocket experiments shows VTF can be used to appropriately study ionospheric plasma processes, and complement active experiments in space.

THE ANALYSIS AND DECONTAMINATION OF DENTAL UNIT WATER LINES

Jennifer F. Nemeth
Graduate Student
Department of Chemistry
Emory University

Abstract

The study was performed to determine the extent of microbial contamination in dental unit water lines at four U.S. Air Force Dental Clinics to evaluate a method for decontaminating and maintaining them on a routine basis. Experimental results indicated water from dental unit water lines in untreated units was contaminated with $>10^5$. Both 1:10 and 1:100 chlorine bleach (NaOCl) solutions were capable of reducing bacterial growth over time. A simple method for cleaning the units was developed using a 1:10 sodium hypochlorite solution. The preliminary evaluation suggests that a 1:100 dilution of sodium hypochlorite may also be effective for long term control of dental unit water line bio-film following initial disinfection.

USING LASER DYNAMICS TO PROBE INTRACAVITY COLLISIONAL RELAXATIONS

Jeff Nicholson
Graduate Student
Wolfgang Rudolph
Associate Professor
Department of Physics and Astronomy
The University of New Mexico
Albuquerque, NM 87131

Abstract

The pulse parameters of a photolytic, gain-switched iodine laser are measured for different pressures of active gas and for various buffer gases. A rate equation model of the laser dynamics is fit to experimental data, to obtain information about collision-controlled relaxation processes of atomic iodine.

PACKAGING AND TESTING OF HIGH SPEED VERTICAL CAVITY SURFACE EMITTING LASERS FOR VERTICAL OPTICAL INTERCONNECTS

Sean S. O'Keefe
Graduate Research Assistant
Department of Electrical Engineering
Cornell University

Abstract

Vertical cavity surface emitting lasers (VCSEL's) are important sources for optical communication architectures, but they have the problem of being very temperature sensitive. Thus, heat sinks were fabricated on metallized thin film diamond wafers and VCSEL's were flip-chip bonded to these heat sinks. The packaged devices were then tested using microwave modulation techniques to determine their -3dB modulation bandwidth. Devices with ten and fifteen micron diameters were tested and the 15 μm diameter devices showed a maximum bandwidth of 6.6 GHz. These devices and this bonding sequence are compatible with continuing work on the vertical optical interconnect project at Rome Laboratory.

AN INTRODUCTION TO PULSED POWER TECHNIQUES FOR X-RAY LASERS

Bryan R. Olsen
Graduate Student
Department of Physics and Astronomy
Brigham Young University

Abstract

Recent demonstrations of x-ray wavelength lasers in capillary discharge devices indicate the important role that pulsed power technology will play in the development of "table top" x-ray lasers. This paper reports on the Marx generator that is being prepared for x-ray laser studies at Phillips Laboratory. Some research groups have also theorized that fast pulses, at energies low enough that a Marx generator is not necessary, could be useful in creating the necessary plasma conditions for x-ray lasing. In light of this theory, details on a small pulse forming network are also contained in this report.

ON THE OPTIMIZATION OF BINARY PHASE ONLY FILTERS USING GENETIC ALGORITHMS

Robert Vincent Opalecky
Teaching Fellow
Department of Mathematics
University of North Texas

Abstract

A genetic algorithm is defined and empoyed as a search algorithm for binary phase only filters used for image recognition and discrimination. When a population of binary strings is used, the setup for such an algorithm is simple, but the efficiency of a genetic algorithm search suffers from the size of the search space and the time required to evaluate the fitness function. Search results are presented, and a comparison with another simple search techniques is made.

A STUDY OF THE RECOVERY OF TRICHLOROBENZENE FROM A CATIONIC ENHANCED SORPTION ZONE IN COLUMBUS AQUIFER MATERIAL USING A NONIONIC SURFACTANT

Angela J. Parlier
Graduate Student
Department of Civil Engineering
Auburn University

Abstract

The viability of the recovery of trichlorobenzene (TCB) from a cationic surfactant enhanced sorption zone in Columbus aquifer material using a nonionic surfactant was studied. A simulation of the cationic enhanced sorption zone was created by treating Columbus aquifer material. TCB was introduced into the column and shown to be retarded in the enhanced sorption zone. When flushed with a nonionic surfactant at a concentration greater than the CMC, the TCB will partition into the micelle phase and can be recovered.

THE SORPTION OF HUMIC ACIDS ONTO AQUIFER MATERIAL SOLIDS

by

Michael J. Piana

Graduate Student
Department of Chemistry
California State University, Northridge

Abstract

A study was made of the sorption of commercial Aldrich humic acid and IHSS Suwannee River humic acid onto three natural aquifer material solids from Barksdale AFB, Louisiana; Blytheville AFB, Arkansas and Columbus AFB, Mississippi . The interactions follow trends found in other humic acid-mineral sorption studies. Increase in pH caused sorption of humic acid on each sediment to decrease. Humic substances sorb more strongly to sediments with considerable surface areas, and surface iron coupled with substantial silt and clay percentages relative to sand. Humic acids with similar O/C ratios and aromatic content had similar sorption capacities on the aquifer material. Ionic strength effected sorption, the concentration and type of ionic strength buffer used governed the extent to which humics sorbed. Phosphate buffer competes with the humic acid for sorption onto the aquifer material solid. Perchlorate buffer tends to alter the structure of the humic acid causing it have different sorption capacities on the aquifer solids. Sorption was greater on the aquifer solids at I = 0.1 M than at I = 0.005 M. All isotherms were evaluated for Freundlich, Langmuir and linear fits. The sorption data favored Freundlich-type statistical treatment.

TEMPERATURE VISUALIZATION OF A ROTATING DISK FLOW FIELD USING THERMOCHROMIC LIQUID CRYSTALS

Lon H. Preston
Graduate Student
Department of Mechanical Engineering
The Pennsylvania State University

Abstract

It is recognized that that turbine disk design requires specific knowledge of heat transfer processes to predict stresses and disk life. This study examines the effect of radial outflow coolant air on heat transfer processes on a heated, rotating disk. A major consideration is the stability of the flow field, which, in actual turbines, is affected by the ingress of hot combustion gases and the flowrate of coolant air. The rotating configurations include rotor-stator, co-rotating, and counter-rotating disks. A program was initiated which has the objective of temperature visualization of the flow field using thermochromic liquid crystals. A liquid crystal coating is applied to the heated rotating disk. The project considers the application and calibration of liquid crystal coatings, illumination of the surface and color temperature acquisition software.

RECEIVED SEP 2 8 1995

SEROTONERGIC INVOLVEMENT IN PHOTIC-INDUCED PHASE ADVANCES OF HAMSTER CIRCADIAN WHEEL RUNNING ACTIVITY

Anne F. Riberdy
Department of Psychology
Boston University

Abstract

A hypothesis is presented which proposes that serotonin (5-HT)$_{1B}$ autoreceptors are located on retinal afferents which project to the suprachiasmatic nucleus (SCN). It is theorized that 5-HT binding at retinal afferents exerts an inhibitory effect on glutamate at the level of the synapse between the retinohypothalamic tract (RHT) and the SCN. Receptor autoradiography as well as behavioral experiments were carried out in order to substantiate this claim. Results suggest that although serotonin does appear to modulate glutamate release at the level of the SCN, the 5-HT receptor subtype which mediates this mechanism is unclear.

SOLID PHASE MICROEXTRACTION FOR MONITORING WATER SOLUBLE JET FUEL COMPONENTS IN GROUND WATER

Jason P. Ritter
Graduate Student
Department of Chemistry
Clarkson University

Abstract: The water soluble fractions of aviation jet fuels were examined using solid phase micro extraction. Gas chromatographic profiles of microextracts obtained from the headspace of water samples contaminated by neat jet fuels revealed that each jet fuel water solvable fraction possessed a characteristic profile. This suggests that the fuel contaminant can be identified from the gas chromatograms of the dissolved hydrocarbons.

AN INTER-FRAME CONSISTENCY MEASURE
FOR THE EVALUATION OF
MOTION ESTIMATION ALGORITHMS

Sharla Lynne Rohrbacher
Graduate Student
Department of Electrical Engineering
Wright State University

Abstract

A great deal of useful information can be extracted from a time-varying sequence of images. Motion estimation is an important research field. Its applications can be found in video image coding and enhancement, 3-D structural analysis, robotics, automatic target recognition, and medical image analysis. While different optical flow techniques continue to appear, there has been a lack of quantitative evaluation of existing methods. The future research in motion estimation is limited due to the lack of a standardized measure for motion estimation algorithms. To evaluate the performance of a motion estimation algorithm, the correct optical flows associated with an image sequence must be known. For a real image sequence, accurate optical flows are difficult to obtain due to such complex factors as measurement error in motion speed and direction, camera calibration error, digitization timing errors and lighting source. Image sequences with known optical flows can be synthetically generated, such as the Yosemite sequence. The synthetic processes are difficult, expensive, and the synthetic gray scale image is much different from the real optical intensity received from a camera. Without the knowledge of correct optical flows, researchers can only observe the estimated optical flows and make some subjective comments and qualitative judgements. To evaluate the performance of motion estimation algorithms, a comprehensive scoring system which can provide objective evaluation of such algorithms for real image sequences should be developed. One such measure in this scoring system is inter-frame consistency.

Optical Current Controlled Oscillators For Microwave Communications

David H. Sackett
Department of Electrical Engineering
Rochester Institute of Technology

Abstract

Most available Laser Diodes(laser diode) display varying degrees of Self-Sustained Pulsation(SSP). SSP, TSP(Transient-Sustained Pulsation), and FSP(Feedback-Sustained Pulsation) are forms of Optical Current Controlled Oscillators. The characteristics of SSP were explored and optimized to create a communication system utilizing SSP as a microwave sub-carrier upon an optical carrier. A feedback system and filtering were used to stabilize the SSP and TSP resulting in an FSP communication system. The FSP communication system was unsuccessful in producing reliable bit error rates due largely to carrier harmonics, non-linear modulation, and excessive noise.

Turbulent Atmosphere Modeling and Atmospheric Short Exposure OTF Evaluation

Kevin Scales
Graduate Student
Department of Physics
University of New Mexico

Abstract

Modeling of propagation through a turbulent atmosphere was studied by evaluating a solution for the Helmholtz equation. Refractive index variations were modeled in a three dimensional manner unlike the common phase screen approach. An evaluation of the short exposure atmospheric OTF is evaluated numerically and compared to Fried's approximation.

APPLIED PERSONNEL TESTING: DIFFERENTIAL ITEM FUNCTIONING ON MEASURES OF COGNITIVE INFORMATION PROCESSING

Cynthia A. Searcy
Ph. D. Candidate
Department of Psychology
Univsersity of Georgia

Abstract

A subset of the Applied Personnel Testing battery (APT) was examined with respect to differential item functioning (DIF). From the battery of 17 tests, 14 were assessed to determine the degree to which ability tests generated from a cognitive information processing perspective would be susceptible to nonconstant group performance, or differential responding for groups across ability levels. Four DIF indices were utilized: $Mh\chi^2$, DD, STD, and RMSWD. Negligible group differences in relative ability were observed for 10 of the 14 tests. Only moderate DIF was observed for two of the remaining four tests, likely due to the nature of the constructs being measured by the tests. The final two tests demonstrated some amount of DIF; it is likely that differential exposure to the concepts measured by these tests were a factor in these results.

Skill retention and decay:
Methodological and conceptual issues

Pamela Stanush
Graduate Student
Department of Psychology
Texas A&M University

The overall objective of the following paper is to examine conceptual and methodological issues that should be addressed in research investigating skill decay and retention. Previous research in this area has suffered from weaknesses and inconsistencies that make drawing literature difficult. The following issues will be discussed: The importance of skill decay and long-term retention from the perspective of the military and its current training programs and protocols; and the methodological and conceptual problems with the variables and research designs that have been used in past and current skill retention/decay research. Suggestions for future research and a proposal for two follow-up studies that attempt to investigate the relationship between individual differences and long-term retention of skill decay are included.

TEMPORAL PROCESSING: AN EXPLORATION OF TEST VALIDATION, COGNITIVE FACTORS, AND INDIVIDUAL DIFFERENCES

Mark J. Stimson
Doctoral Student
Department of Psychology
The University of Georgia

Abstract

The purpose of this study was threefold: to develop tests to measure temporal processing; confirm hypothesized latent factors of temporal processing; and investigate the relationship between temporal processing and working memory (i.e., individual differences). Human subjects were administered a series of different temporal processing tests that varied on several levels, as well as a battery of working memory tests. Several analyses were performed on the data. Inspection of the correlation matrix and a confirmatory analysis of the measurement model indicated construct validity for both temporal processing and working memory. Significance tests conducted on the temporal processing tests showed an increase in error with an increase in test duration. Finally, structural equation models confirmed hypothesized factors involved in temporal processing, and individual differences in working memory.

A HYBRID MM/GTD NUMERICAL TECHNIQUE FOR LOSSY DIELECTRIC ROUGH SURFACE SCATTERING CALCULATIONS

James C. West
Associate Professor

James Michael Sturm
Graduate Research Assistant

School of Electrical and Computer Engineering
Oklahoma State University

Abstract

A hybrid numerical technique combining the moment method and the geometrical theory of diffraction has been extended to allow the calculation of electromagnetic scatter from lossy dielectric surfaces. The hybrid technique eliminates the non-physical edge effects that are introduced in standard moment method implementations, thereby allowing the application at extreme grazing angles. The dielectric surface is represented using impedance boundary conditions. Sample calculations demonstrate the reduction in scattering from a rounded-apex wedge when the surface conductivity is reduced. The technique should allow more realistic calculation of the scattering from land and water surfaces than can be obtained using a perfectly conducting surface.

THE ONSET OF CIRCULATORY SHOCK INDUCED BY MILLIMETER WAVE EXPOSURE IN RATS

Maria Tehrany
Research Associate
Department of Biology
Trinity University

ABSTRACT

Exposure to 35-GHZ microwave heating leads to circulatory shock and subsequent death. The purpose of this study was to determine at what mean arterial pressure (MAP) circulatory shock is irreversible. Four groups of rats (n =6 groups) were anesthetized with ketamine, surgically implanted with a catheter in the left carotid to measure MAP and exposed to 35 GHZ radiofrequency radiation until MAP was equal or less than 70 mmHg, 80 mmHg, 90 mmHg or control (MAP matched pre-exposed MAP). During exposure, EKG, temperatures at five sites and MAP was measured. Rats in 90 mmHg and control groups, for the most part, survived after MMW radiation, while most rats in 70 mmHg and 80 mmHg did not. Concluding, there is irreversible circulatory failure in rats, in most instances, after MMW exposure until MAP$\leq$ 80 mmHg.

A GENERAL METHODOLOGY FOR CLUSTERING AND SEQUENCING ALGORITHMS WITH APPLICATIONS TO INTELLIGENT KNOWLEDGE-BASED MANUFACTURING/MACHINING SYSTEMS

Georges A. Bécus and Edward A. Thompson

ABSTRACT

Product design and process planning have been separate activities. Even with the advent of computer aided design, CAD systems have been extensively used in the automation of product design, while process design or planning has remained a separate and primarily manual effort with little or no automation. Although there have been numerous efforts (e.g. group technology involving variant and generative techniques) and research in the area of product design and process planning integration, most research has addressed only a portion of the problem, i.e., either the product design or process planning. The integration of shape, function, material and process design is a goal which offers many challenges to overcome. After reviewing Adaptive Modeling Language (AML), an approach and implementation for integrating product and process design in a virtual manufacturing environment involving competing processes, this report presents a general methodology and general purpose algorithms for clustering and sequencing under (precedence) constraints. These algorithms could easily be integrated in AML or other Intelligent Knowledge-Based-Engineering systems to perform such tasks as setup generation/sequencing and feature/operation sequencing. The algorithms employ an Annealing Genetic strategy together with special purpose operators and repair functions as the optimization engine. Our approach, flexible enough to allow user interaction, finds very quickly (near) optimal solutions of higher quality than existing methods.

KEYWORDS: Intelligent Knowledge-Based Engineering, Adaptive Modeling Language, Process Planning, Operation-Based Design, Machining, Clustering, Sequencing, Annealing Genetic Algorithm.

INTRODUCTION

Today enterprises have to compete in an ever changing global market environment which requires fast appropriate decisions. Process costs and product affordability, which form the basis for competing in the marketplace, are often adversely affected by customer demands dictating quick response and imposing continual changes to the product development cycle therby lengthening development time. Investigating new materials and processes to lower costs while enhancing product performance is a goal pursued by every manufacturer.

INSTALLING A LASER FOR SHADOWGRAPHIC HOLOGRAPHY OF BALLISTIC IMPACT EVENTS AT WRIGHT-PATTERSON AFB

William J. Turner
Graduate Student
Department of Mathematics
Iowa State University

Abstract

Wright Laboratory is in the process of obtaining an ANSI Class 4 laser to study ballistic impact events. The laser will provide WL/FIVS with shadowgraphic holography capabilities. Before the laser can be used at WPAFB, certain facility and safety requirements must be met, and the base Laser Safety Officer (LSO) must issue a permit for the approved use of the laser in a proposed location.

Operating this laser is not an easy task, and many materials, ranging from dyes to mirrors to oscilloscopes, are required to maintain the laser. In addition, the film must be developed in a particular manner to get a good holographic image.

Once a the three dimensional image is obtained, it must be digitized to do computer analysis. Basic research on digitizing three dimensional holographic images originated at Sandia National Laboratory, but was never completed due to financial cutbacks and organizational restructuring.

ATM DS-3 EXPERIMENTS VIA THE ADVANCED COMMUNICATION TECHNOLOGY SATELLITE

Valentine Aalo
Electrical Engineering Department
Florida Atlantic University

Okechukwu Ugweje
Electrical Engineering Department
Florida Atlantic University

Mostafa Chinichian
Electrical Engineering Department
California Polytechnic State University

Abstract

A series of experiments were conducted via the ACTS DS-3 link carrying ATM traffic in a PLCP frame format. These experiments were performed between Rome Laboratory, Griffiss Air Force Base, New York and Communication Research Centre, Nepean, Canada. These tests were conducted to test the viability of ATM DS-3 bearers via the satellite at a performance level comparable to that of terrestrial fiber optic link or microwave link. In these tests, both single and multiple channels configurations of ATM satellite bearers were tested. The single channel experiments were configure to fully load the channel at 96,000 Cells per second, while the multiple channel experiments were used to assess the ability of ATM protocol to carry information from different sources at different rates. Our main objective of characterizing the DS-3 satellite channel for the transmission of ATM signals was achieved, and the result obtained were presented and analyzed.

A STUDY OF THE POSSIBLE ANTIFUNGAL AND ANTIMICROBIAL PROPERTIES OF THE COMMON GREENBRIER

Nicole M. Adams
Rutherford High School

Abstract

Based on field observations, it appeared that *Smilax rotundifolia* or Common greenbrier had no natural predators. It was suggested that this plant might exhibit antimicrobial or antifungal properties. Several other plants in the *Smilax* genus demonstrate antifungal properties. The following experiments were designed to test the plant extracts for these properties. The first set of experiments were designed to examine the effects of plant proteins on the growth of *Pseudomonas aeruginosa* and yeast cells. To prevent denaturing of proteins, a non-boiling physical extraction process was used. The plant extract was tested on agar plates and then in liquid cultures. After receiving literature which contained a procedure for extraction of *Smilax* compounds which inhibited fungal growth, the extraction process was modified to include a boiling process, an evaporation process, a filtering process, and a phase to monitor the long term results. The results show that the tuber or main root of the plant has some compound(s) that inhibits the growth of yeast cells.

DOCUMENTING A COMPUTER PROGRAM

Blake E. Ahrens
Albuquerque Academy

Abstract

Documentation of a program used by the Electromagnetic Effects Division was almost completed. A valuable lesson and several software programs were learned. Organization was quickly developed. The foundation for the documentation of the BLWGN program was laid for those to follow.

PUBLISHING ARMSTRONG LABORATORY TECHNICAL DOCUMENTS ON THE WORLD WIDE WEB

Anita Anderson
Judson High School

Abstract

The World Wide Web is an effective, low-cost platform for information presentation. Creating and posting Technical Papers and Technical Reports on the Web allows Air Force researchers to reach a wider audience for a lower cost than printing and distributing paper documents. Because many Air Force Technical Papers and Technical Reports are authored in *Microsoft Word*, an easy to follow guidebook for changing such documents into HyperText Markup Language is needed. The necessary steps to change *Microsoft Word* documents into HyperText Markup Language are outlined with suggested readings for further information. Such methods were found to produce effective results.

ADVANCED C/C++ PROGRAMMING, GRAPHICS TECHNIQUES, AND NETSCAPE ENHANCED HYPERTEXT MARKUP LANGUAGE

Jonathan C. Bakert
Sauquoit High School

Abstract

Numerous advanced C/C++ programming functions and methods were studied including overloaded functions, pointers to functions, and modularity techniques, as well as graphics techniques, such as image scaling, rotation, translation, double-buffering, palette manipulation, and ray-casting. In addition, the HyperText Markup Language (HTML) was learned in order to develop a "home page" accessible through the world-wide web, or WWW. Integrated into the HTML were clickable imagemaps and C code written to translate a decimal number (base 10) into a hexadecimal number (base 16).

A STUDY OF THE THERMAL BREAKDOWN OF TRICRESYL PHOSPHATE

Matthew L. Blanton

Abstract

The gas phase thermal decomposition of tricresyl phosphate was studied. To measure the chemical breakdown of tricresyl phosphate, amounts of up to 0.2 microliters of tricresyl phosphate were injected into a high temperature thermal reaction compartment (TRC) for thermal stressing. From there, the reaction products were focused onto a gas chromatograph - mass spectrometer (GC-MS) for separation and identification of thermal decomposition products. The results of the experiment reveal that tricresyl phosphate is highly stable in air at temperatures up to 500 degrees Celsius.

SCANNING ELECTRON MICROSCOPES

Johnna Brough
Miamisburg High School

Abstract

Scanning electron microscopes are used for various subjects and in various fields. My designated project was to catalog various specimens using an E-TEC microscope dating from around the mid-seventies. This catalog was to be used in various briefings and conferences by the lab who provided my sponsorship. I was given a partner to work with and we completed what we hope will be a useful resource for our sponsors and other educators. My partner and I have both had previous experience with scanning electron microscopes. but this program helped us to define our skills as well as giving us experience in a business environment.

SUPPORT OF LASER RADAR (LADAR) AUTOMATIC TARGET ACQUISITION (ATA) ALGORITHM DEVELOPMENT AND EVALUATION

Kimberly N. Cabral
Choctawhatchee High School

Abstract

The creation of an automatic target acquisition algorithm for detection, identification, and aimpoint selection of fixed high-value and critical mobile targets was studied. Three-dimensional, wire frame models were generated to aid in the identification process. Targets were extracted from real ladar range imagery also to aid in the process. For future use, the synthetic images would be compared to the actual (unidentified) targets. Through an organized process, the actual target could then be identified.

A Study of Air Traffic Controllers Dietary Qualities

Heather Castellano
AOCR, High School Scientific Apprentice
Brooks Air Force Base Armstrong Laboratories

Abstract

Concerns have risen in regard to the overall wellness and performance of air traffic controllers on the forward rapid rotation schedule. Since the Professional Air Traffic Controller's Organization strike in the early 1980s, publicity has evoked much concern over the health of ATCs.[2] It can be questioned whether forward rapid rotation schedules compound the already stressful job of air traffic controllers, increasing risks for both the ATCs and air safety. Several aspects of health were studied and evaluated to determine the effects of the rotation schedules on ATCs. Only slight differences was found in the DQI scores between the ATCs and the control group, indicating that the rotation effects are minimal.

The Effect of Hyperbaric Oxygenation and Hypobaric Exposure on Peripheral Blood Mononuclear Cells

Ai-Hsin Cheng
Brackenridge High School

Abstract

The proliferation of peripheral blood mononuclear cells (PBMC's) under various atmospheric stressors was studied. PBMC's were extracted from remnant blood using the density gradient provided by Histopaque solution. The cells were then exposed to conditions equivalent to 45 feet below sea level and 85,000 feet above sea level. The conclusion made after the experiment was that hyperbaric oxygenation suppresses the proliferation of PBMC's, while exposure to hypobaric conditions increases cell proliferation.

Programming Psycho-motor Tests Involving Risk Assessment

Will P-Z. Clark
Alamo Heights High School

Abstract

In order to determine how well risk assessment tests measure individuals' behavior, I, under the auspices of Dr. Joshua Ben Hurwitz, programmed a psycho-motor test to measure behavior. The test involved two arcs rotating around a gun in the middle of the computer screen. The gun fired bullets at two different speeds. Subjects had one shot per trial, and gained a number of points inversely proportional to the time and lost a constant number of points (always more than the number gained).

The program was written in object Pascal, specifically Borland Pascal 7.0. With extensive comments and the graphical instructions, the main program was 759 lines. However, the nature of the task necessitated the creation of two other programs. One created the data file which initialized the bullet speed, arc size, arc speed, and arc starting position; it was approximately 123 lines. The other file, approximately 375 lines, took the data file output from the main program and rearranged it and formatted it for importation into a statistical analysis program for Windows™ called SPSS™.

Diverse Electronic Warfare Applications

Allyn J. Crowe
Bellbrook High School

Abstract

Various Electronic Warfare software applications were studied. GW Basic, Visual Basic, HT Basic, Microsoft Excel, DaDisp, Matlab, and Design-Cad were some of the programs used. Building circuits, troubleshooting and repairing electronics, IEEE-488 interfacing, writing computer programs, drawing block diagrams, and performing a link analysis were some of the activities performed. One side project is discussed briefly: The linking of two computers so that all of the drives on both computers can be used on one. One of the main programs written is also included.

A STUDY OF THE RADAR SYSTEM AND THE C PROGRAMMING LANGUAGE

James R. Decker
Sauquoit High School

Abstract

In this research experiment the radar system and the C programming language was studied. The C programming language was learned to aid in the placement of the radar systems into an existing virtual reality environment. The graphics language of C was to assist in placing radar systems into the virtual reality environment.

PERL And AWK Based Post Processor
For EPIC FEM Computation

Michael Dooley
Niceville High School

Abstract

This paper documents the development of a PERL and AWK based post-processor for the EPIC Finite Element or FEM hydrocode. The post-processor, called POSTER, gives three levels of summary reports from EPIC textual output files. The reports give the user a method of quickly evaluating the major run parameters for a completed simulation with EPIC.

ELECTROMAGNETIC FIELDS AND CELLULAR ADHESION

Rebecca Jeanne Dylla
East Central High School

Abstract

Cell membrane exteriors are known to have a net negative electric charge, thus electrostatic forces are important to cell adhesion. By calculation, it was determined that the electrostatic repulsive force between cells should be extremely large. Comparison of these forces to experimental values determined by others showed that electrostatic screening and probably additional physical mechanisms must be reducing the amount of repulsive force between two cells. Electromagnetic fields can alter the charge on the membrane exterior, and thus the electrostatic force; therefore, they may affect cellular adhesion. This could be important to the field of cancer therapy and in health and safety considerations, since altered adhesiveness is a characteristic of cancer cells. Therefore an experiment to test the effect of electromagnetic fields on cell adhesion was proposed.

FLOW ANGLE MEASUREMENT FOR THE TURBINE RESEARCH FACILITY

Mark Fecke

Abstract

In order to evaluate turbine performance, pressure and temperature measurements must be made at the inlet and exit of the turban blade row. Since the turbine is rotating, the flow direction relating to the measurements location may vary. The objective of this work was to measure this flow angle at the exit of the test turbine. Because of the transient nature of the flow a hot-film anemometer was used to measure the flow angle. This paper documents the calibration of the hot-film at two different total temperatures and presents a theory for using the hot film to determine flow angle at elevated temperature. Finally the flow angle measured during a turbine test is presented.

"RADIATION DOSIMETRY"
WHAT IS IT ?

Nicholas Flores
St. Gerard Catholic High School

Abstract

The procedure of issuing and receiving personal radiation dosimeters for both monthly and quarterly periods was studied. More than twice the number of dosimeter badges were used for a quarterly period than for a monthly. The office in which I worked was very cramped for the number of people employed. However everyone did an excellent job processing the badges. Ergonomics was a concern also, but when I left they were addressing the problem and I am confident that they will make that office a better, more comfortable place to work.

DELAMINATION IN GRAPHITE/EPOXY PLATES
CAUSED BY LOW-VELOCITY IMPACT

Craig M. Fortner
Thomas Worthington High School

Abstract

The research program sponsored by the Air Force Office of Scientific research included several projects and activities instead of the normal singular project. The goals this summer included assisting Bryan Foos with research for both his Ph.D. from the Ohio State University and his work for the Nondestructive Evaluation Branch of the Materials Laboratory at Wright-Patterson Air Force Base. One of the main projects was ultrasonic scanning of graphite/epoxy plate for delamination at each layer. An instruction manual was later written for the ultrasonic scanning tank. Other projects included mounting and testing strain gages, bonding thermoplastics, cataloging references for Mr. Foos' dissertation, and creating a homepage on the Internet.

A STUDY OF SUBSTITUTED GLUCOPYRANOSE USING SINGLE POINT CALCULATIONS WITH AM1 GEOMETRIES

Alfredo J Garcia
Carroll High School

Abstract

The use of toxic de-icers costs the government large sums of valuable revenue. In hopes of reducing costs both financially and environmentally, this study was created to research the development of nontoxic de-icers through the process involved with the substitution of basic compounds onto a specific sugar. Glucopyranose was the target skeleton sugar in this study. The key to this research is in the comparison of log P of the variable compounds to the log P of present de-icers. The Ampac Solvent Package (Amsol) was employed to determine the log P value of the substituted molecule. Single point calculation parameters and AM1 geometries were the established limits set for the tests. Simple organic compounds were the substituent variables located at differing locations on the molecule. Experimental results show that there are possible candidates for the replacement of present de-icers, yet before these compounds can be established as replacements, more investigation of these candidates is required.

DEVELOPMENT OF AN INVESTMENT PROJECT DATABASE

Derek E. Geeting
Shelbyville Central High School

Abstract

A database to store and maintain information about investment projects for the current fiscal year was created. Database programming was first learned. Then, a working database was created. Next, data for the upcoming fiscal year (1996) was entered into the database. From this point data can be easily modified or rearranged. Also, informative reports can be created which give detailed information about the investment project data such as summaries of project data. Finally, the database was made expandable, in case the projects of other subtasks or sections need to be added later.

The Effect of Hyperbaric Oxygenation
and Hypobaric Exposure on
Peripheral Blood Mononuclear Cells

Paul D. Giles
James Madison High School

Abstract

The proliferation of peripheral blood mononuclear cells (PBMC's) under various atmospheric stressors was studied. PBMC's were extracted from remnant blood using the density gradient provided by Histopaque solution. The cells were then exposed to conditions equivalent to 45 feet below sea level using a hyperbaric chamber, sea level as a control, and 85,000 feet above sea level using an altitude chamber. The experimental data indicated that hyperbaric oxygenation suppresses the proliferation of PBMC's, while exposure to hypobaric conditions increases cell reproduction and survival compared to the control.

AN INVESTIGATION OF NEURAL NETWORK PROGRAMMING AND USE FOR FINDING RELATIONSHIPS AMONG SPIRAL INDUCTOR DATA

Stephen M. Govenar
Beavercreek High School

Abstract

In this investigation, a neural network simulation program written in the Pascal programming language was converted to the C programming language. Later, an existing C program was modified to include sensitivity, correlation, and error calculations, and user interface changes were made. Rectangular spiral inductor physical characteristics, equivalent circuit parameters, and S-parameters were used to train and test the neural network.

Abstract

The problem currently facing the Air Force is how to make a material light weight yet very strong. To use less material metals have been put through a series of processes to make them stronger and so less metal has been required but this is still to heavy for use in today's aircraft. The solution looks to be in the direction of using fibers imbedded in the material to greatly increase the strength but dropping the weight considerably. This process works very well but is still in the testing stages. The current tests being done are mainly on the fibers themselves which are tested in many ways. One such test was done on a set of fibers that were tested as received being the control group and another group were heat treated then they were tensile tested by adding increments of load until they failed. The fibers were then prepared and viewed to determine the reason for failure using a scanning electron microscope. The final step in the process was to analyze the data that was collected.

THERMAL EFFICIENCY OF A FLEXIBLE HEAT PIPE SUBJECTED TO HEAT FLUX AND TRANSIENT ACCELERATION ENVIRONMENTS

Shaun R. Guillermin
Chaminade-Julienne High School

Abstract

The effects of transient acceleration and heat input on a flexible heat pipe were studied. A flexible heat pipe was mounted on a centrifuge table to observe its response to combined variances in acceleration and heat in a simulated high performance aircraft environment. Heat input was transmitted via a heater in the evaporator section, while maneuvering was replicated by varying the frequencies of a sawtooth wave pattern in a low to high g setting. Dry out induced hysteresis can exist which produces two data sets for a given input. Thermal resistance was low for lesser heat values and/or higher frequencies. It was concluded that this particular heat pipe is more efficient at higher frequencies.

ASSEMBLY LANGUAGE AND C DESIGN VERIFICATION AND TESTING OF A SCALABLE, PROGRAMMABLE, DIGITAL SIGNAL PROCESSOR

Eric J. Hayduk
Rome Catholic High School

Abstract

Test programs that will be used to verify the design of the Floating Point Application Specific processor (FPASP5), a scalable, programmable, digital signal processor, were developed. The test programs were written using an assembly language specific to the FPASP5. Several programs written in C, a multipurpose programming language, were used to generate data tables for the Arithmetic Logic Unit (ALU) test program. Test programs were also developed to examine all registers, the incrementers, the C and D pointers, the C and D incrementers, all branch conditions that are available to an assembly language programmer and other assembly language commands. In addition, a flexible program was written to allow an individual test or multiple tests to be executed. Test programs and their usefulness in debugging the FPASP5 are discussed along with problems, corrections, and future steps to complete design verification.

DECOMPOSITION OF ENERGETIC MATERIALS
USING SODIUM HYDROXIDE

Venessa L. Hurst
Walton High School

Abstract

Base Hydrolysis was studied to determine what affects it would have on explosive decomposition. The base used was Sodium Hydroxide. Two explosives were chosen to be tested: Nitroguanidine (NQ) and 1,3,5,-Trinitro-1,3,5 triazocyclohexane (RDX). NQ was used to duplicate the procedure used by Dr. Spontarelli at Los Alamos National Laboratory in New Mexico, and to become familiar with the test. The experiments with RDX were used to look mainly at the generated data and to improve the setup for future experiments.

A STUDY OF THE EFFECTS OF N-VINYLPYRROLIDONE ON METHYLENE BLUE BASED POLYMER DISPERSED LIQUID CRYSTAL SYRUPS

Jennifer M. Johnson
Carroll High School

Abstract

The results of varying the percentage composition by weight of N-vinylpyrrolidone (NVP) was studied. Syrups with NVP percentages from 0 to 20% at intervals of 5% were created and mixed. Samples from each syrup were exposed to a HeNe laser at 632.8nm for a period of 5 minutes and at an intensity of 3.2mW to 3.8mW so that a Bragg grating could be written. These samples were then characterized by finding their diffraction efficiencies in both s and p polarization. Results were that the optimal percentage for NVP was around 14.5%.

F-16 EM SCATTERING

Sharleen P. Johnson
New Hartford High School

Abstract

The EM (electromagnetic) scattering off an 1/32 scale F-16 was studied, using an IR (infrared) measurement technique. Carbon loaded Kapton paper, sensitive to EM radiation, increases in temperature in a direct proportion to the intensity of the radiation. An IR camera, tied in to AGEMA Thermovision software, detects the temperature on the paper and allows this information to be processed. The model F-16 was placed into a hole in the paper, radiated with EM radiation from a horn antenna, and the EM scattering was measured using an IR camera. This is a thorough, time and cost efficient method of measuring EM scattering.

CHAOS AND THE DIODE RESONATOR

Rebecca Kalmus
Sandia Preparatory School

Abstract

The periodic and chaotic properties of the diode resonator were investigated. Liquid nitrogen was used to study the effects of temperature on the resonator. Different combinations of frequency, amplitude, DC offset, and temperature were used as control parameters of the resonator driver. The goal of the experiment was to find high periods and antimonotonicity. By the end of the summer, both high periods and antimonotonicity had been observed.

A MOS APPROACH FOR THE PREDICTION OF SUMMERTIME CLOUD COVER OVER NEW ENGLAND

Hong Van M. Le
Chelmsford High School

ABSTRACT

Model Output Statistics (MOS) is an objective weather forecasting technique that determines a statistical relationship between the predictand (cloud amount) and predictors (forecast variables) by using a numerical model at some projection time. This research project focused on the generation of MOS equations and the analysis of those regression statistics. Four cities were chosen to conduct the project: Boston, MA; Concord, NH; Burlington, VT; Caribou, ME. The forecast data was collected from the Eta Model, an operational weather prediction model that carries out forecast information to forty-eight hours. The variables used to predict cloud amount in New England during the summer included: U and V wind components, vertical velocity, lifted index, six-hour precipitation amount, and relative humidity at three levels in the troposphere. A multiple linear regression was performed to calculate correlation coefficients that are a measure of the relationship between a predictor and cloud amount. Significance testing was done to determine the degree of confidence in the correlation. Results showed that the degree of correlation generally decreased with forecast length. Verification tests showed that at certain stations, the MOS equations showed some skill at forecasting cloud amount.

AN ANALYSIS OF OIL/GREASE
IN WATER AND SOIL

Adriana Y. Lopez
East Central High School

Abstract

An analysis of oil and grease in water and soil samples was conducted. Water samples were measured in 500 ml flask containers with an addition of freon and Sulfuric Acid. The samples were agitated by hand and by machine for 3 minutes. After this process, the samples were extracted into 10 ml cylinders. Soil samples were weighed out and freon was added. These were stirred for 2 minutes and extracted into cylinders.

Soil and water samples were investigated for pollutants. An analysis of oil and grease was conducted. Water samples wee measured in 500 ml flask containers with freon and Sulfuric Acid added. These samples were agitated by hand and by machine for 3 minutes. After this process, the samples were extracted into 10 ml cylinders. Soil samples were weighed out and freon was added. These samples were stirred for 2 minutes and extracted into cylinders.

A STUDY OF PRODUCTION CONTROL METHODS AND EVALUATION

Steven James Mattingley
Mosley High School

Abstract

Methods of production control were studied and utilized. The primary example of this study was the Operations Support Section (FIVCB-Wright Laboratory Research Facility) at the 9700 Area of Tyndall Air Force Base. Various production tracking methods were used to monitor both output and efficiency. Methods of reducing material waste on large contracts were studied and employed. Preexisting methods of work efficiency tracking were improved upon and expanded.

COMPUTER-ASSISTED LASER POWER MEASUREMENT

Eric McEuen
Institutionless

Abstract

Work was done on a computer program designed to provide power vs. current (LI) curves for semiconductor lasers. At the beginning of the summer tour, existing LI programs at PL/LIDA assumed a "magic ratio" relationship between voltage sent to the circuit and resulting current flow. Work was underway, separately, on an algorithm to measure current flow from an oscilloscope reading. Both programs were organized in a way that made them difficult to use, and their output was limited to raw numbers. At the time of this writing (3 Aug), the current algorithms have been finished and incorporated with the LI software, with menus and graphs making the program more friendly.

POWER SYSTEMS STUDIES

Eric McMahan
Coffee County High School

Abstract

The Power Systems Analysis team has several basic responsibilities including preventing injury, minimizing system damage, and limiting the extent of outages. Occasionally, an in depth report such as the Central Facilities Report is required. Also, in an effort to better organize information collected by the PSA team over the past five years, a pc-based index was created.

A DATABASE FOR RADIATION INTERACTION MODELING

Jerome C. Michelback
Highland High School

Abstract

The Phillips Lab Satellite Assessment Center performs satellite survivability/vulnerability analyses on radiation interactions with spacecraft. Their analyses include the effects of nuclear weapon produced radiation, primarily high energy electrons, the effects of high energy lasers, and radio frequency effects. They base these analyses on high fidelity models of spacecraft. Essential to their analyses is a well documented and flexible database of material properties. The formats for this database were developed and population of the database was started.

FERROELECTRIC LIQUID CRYSTALS FOR SATELLITE COMMUNICATIONS

Fawn R. Miller
Manzano High School

Abstract

The nature and operation of liquid crystals was studied. Ferroelectric liquid crystal devices were evaluated for use in satellite laser communications. Performance of the ferroelectric liquid crystals was measured by ON-OFF modulation of a laser beam. Measurements were taken from 10 to 500 hertz and results inducate potential future applicaion.

Eight Week Tour at Wright Patterson Air Force Base-Flight Dynamics Directorate

Raviraj Nataraj
Beavercreek High School

Abstract

The following report details the summer research accomplishments of Raviraj Nataraj at the Wright Patterson Air Force Base-Flight Dynamics Directorate as part of an eight week tour sponsored by the Air Force Office of Scientific Research and High School Apprenticeship Program.

SIMULATING A SPACE ENVIRONMENT

Julie Niemeyer
Valley High School

Abstract

In today's growing technological world there is a greater number of satellites and other space vehicles. This in turn requires testing of the future space vehicle and all components of the vehicle before launch. Thermal Vacuum Chambers simulate the space environment. This simulation of the space environment is one of importance and safety. It also saves money, time and energy that can be lost if a satellite cannot function in the harsh space environment. The thermal vacuum chamber can detect the most of the problems that could occur while the satellite or space vehicle is in orbit.

A STUDY OF THE VISCOSITY CHARACTERISTICS OF POLY (VINYL ALCOHOL) (PVA) IN THE SOLVENTS S-HAN 5 AND WATER

Jamie B. Nyholt
Quartz Hill High School

Abstract

The behavior of poly (vinyl alcohol) (PVA) in water and S-HAN 5 was investigated. The sol-gel transitions were studied by varying concentrations of PVA in the solvents water and S-HAN 5. The physical state was observed by the meniscus-tilt method. The affect of concentration and molecular weight on a range of poly vinyl alcohols with varying molecular weights in the solvents water and S-HAN 5 was studied. Elvanol HV, Airvol #103 PVA and Airvol #107 PVA were used. These solutions were made by dilutions of the highest concentration of each soution. Viscosity measurements were taken for each solution at varying concentrations at 25°C. These viscosities were used to find the intrinsic viscosity of each solution. The intrinsic viscosities were then plotted against the weight average molecular weights to find the interaction parameter. This parameter shows the interaction between a specific polymer and solvent at a given temperature, in this case 25° C.

ABSTRACT TESTS PREDICTING PERFORMANCE ON REALISTIC TESTS

Jennifer Patterson

John Marshall High School

ABSTRACT

This study was conducted to determine if more abstract and less expensive tests can predict the performance on more realistic and more expensive tests. Each subject took a battery of tests which lasted approximately three and a half hours. The battery of tests was composed of two psychomotor skills tests, which test hand/eye and multilimb/eye coordination, and a situation awareness test, and two driving simulators, one administered on a personal computer and the other on a modified arcade game. The results showed some significant correlations between the abstract tests and the two driving simulators. There were also some significant correlations between the abstract tests which required similar skills.

A STUDY OF THE FLIGHT DYNAMICS REFERENCE SYSTEM FOR WRIGHT LABORATORY

David M. Pepin
Greenon High School

Abstract

The reference system made by the Flight Dynamics division of Wright Laboratory was studied and improved. The system was put together several years ago using DBase IV, for the purpose of making it easier to find previously written reports. Over the course of several years, the reference system began to lose popularity, and was nearly forgotten altogether. It was decided that in order to get it started again, it needed to be transferred to Microsoft Access so that it could be used in Microsoft Windows. The ultimate goals were 1) to successfully transfer the database from DBase IV to Microsoft Access, 2) to enter several recent reports into the system, and 3) to get people using the system again to find reports and enter some of their own.

DEMONSTRATION OF CD-ROM ARCHIVAL OF TEST INFORMATION

Laura Pickney
Franklin County High School

Abstract

Test information has historically been transmitted to AEDC customers in large books of computer printout, notebooks of photographs, and computer tapes of data. In order to reduce the amount of storage space required for test data, AEDC developed TPAS (Test Project Archival System) in 1994. Some of the many benefits of TPAS were that it was stored on CD-ROM, it was user-friendly with "point & click" icons, and it drastically reduced the amount of space required for data storage. It also contained more information than old-style data packages such as memos, photos, drawings, and videos. The purpose of my project was to construct a TPAS Demonstration that was publicly releasable. By copying the TPAS Demonstration onto CD-ROM and sending it around the country, potential AEDC customers will see the advantages of TPAS and doing business with AEDC.

ELEVATED TEMPERATURE CHARACTERISTICS OF A SILICON DIODE

Angela C. Rabe
Carroll High School

ABSTRACT

The effects of elevated temperature on a silicon diode were tested. The diode was heated in a vacuum chamber, and the forward and reverse characteristics were tested at different temperatures. The temperatures tested were the case (of the diode) temperatures starting at 24C and increasing in increments of 25C until 149C. After all of the current versus voltage data was graphed, the relationship between the current and voltage and the effect of temperature were determined, as well as an analysis of the relationship between the lead and case temperatures and the relationship between the Ln (I) and 1/T.

The case and lead temperatures were found to differ in magnitude due to the varying ways by which they received the additional heat. As far as the relationship between the Ln (I) and 1/T is concerned, they were related through a fourth power curve.

From here it was determined that the temperature had a definite impact on the effectiveness of the diode. In the forward bias, for small positive voltages, the higher temperature settings produced more output current than the liwer temperature settings at the same voltage, up to the point of conduction. For larger voltages, the trend reverses, due to increased internal resistance, and for a constant current, higher temperatures will require additional voltage to reach the same current. In the reverse bias condition, for higher temperatures the breakdown becomes more gradual. Before breakdown occurs, the higher temperature settings produce a greater absolute value of output current than the lower temperature settings for the same relatively low voltage. After the breakdown occurs, the lower temperature settings require a smaller absolute value of voltage in order to attain the same output current value as the lower temperatures.

NEURAL NETWORKS AND
DIGITAL IMAGE PROCESSING

Douglas M. Ritchie
Niceville High School

Abstract

The topic of interest was Neural Networks, Digital Image Processing, and the possibility of a combination of the two. The Neural Network design and testing along with the Digital Image Processing was accomplished through the use of MathWorks' MatLab. The first part of the project was to become familiar with MatLab's Image Processing Capability by programming a scenario for Point-Source Target Tracking. The second part of the project dealt with edge enhancement and boundary detection. The third section of the project dealt with training a Neural Network to classify patterns based on input vectors. The fourth and final part of the project dealt with combining the edge-enhanced image with an association network to determine whether or not it was a target.

A STUDY OF FITTS' LAW ON THE PHANToM™ HAPTIC INTERFACE

T. Travis Ross
Greenon High School

Abstract

Fitts' Law was studied on the PHANToM™ haptic interface. First a virtual task board was constructed to demonstrate Fitts' Law and lay the foundation for future experiments. The task board simply consists of a wall with cylinders protruding out of it. A subject was instructed to touch the top of one cylinder and then the top of the next. The time it took to complete this task along with the diameter of the cylinder and the distance between them was used to compute the subject's capacity (bits/second), which is a measure of human performance. Results prove that a Fitts' Law task can be done on the PHANToM™ and ideas for future experiments have been formed.

THE RELEVANCE OF HYPERBARIC OXYGEN THERAPY IN SPORTS MEDICINE

Rebecca J. Scheel
Madison High School

Abstract

Hyperbaric Oxygen Therapy has been used for some time as a treatment for non-healing wounds and for Decompression Sickness (DCS). It is by no means a new form of medicine, and yet it has just recently been looked at as a possible aid for injuries resulting from sports. Due to time constraints, no lab time was allowed for this project, but extensive research was done, several opinions were sought, and a hypothesis was formed. This paper gives a well defined reason for more research to be done into the area of hyperbarics in sports medicine.

A STUDY OF 3D LASER SCANNING

Kevin C. Schlieper
Tippecanoe High School

Abstract

A three dimentional scanning system which utilizes both a camera and laser system was studied. To scan, a high powered laser was spread into a plane which rotated around the target object. Laser line data was recorded with the camera and stored in the personal computer. This data was then processed to present a three dimentional, x,y,z, axis plot.

After improving on the current design, a new, mobile scanning project was activated. This project is still in the preliminary stage, but the plan is to build essentially the same principle as above, but with a few minor changes including the availability of mobility.

THE USE OF Labview* FOR HEAT-SENSITIVE DATA ACQUISITION

Seth B. Schuyler
Sandia Prepatory School

Abstract

Labview has been recently been introduced into the lab with very positive results. It saves time and increases the output of each individual researcher, all with a minimal cost.

DATAPOINT SUMMARY PROGRAM

Jesse Selman
Franklin County High School

Abstract

A program was written to provide the engineers at Arnold AFB's engine test facility a more rapid and efficient means of getting information about datapoints that were taken from engine tests. Each datapoint has different values for the information that is gathered during a test. The engineers need to know several different values regarding the transfer of each datapoint. The program calculates these values and prints them onto a file with the datapoints.

ADJUSTING THE METHOD USED IN THE DERRINGER WATERJET IMPACT SENSITIVITY TEST

Ryan C. Sheffield
Niceville High School

Abstract

The method used in carrying out the derringer waterjet impact sensitivity test was adjusted in order to make it usable with a new test setup. This test is conducted with a unit known as a water derringer*. During the test, a propellant burns within the derringer, propelling a piston forward, causing water on the opposite side of the piston to be pushed through a nozzle. This nozzle, in turn, projects a high pressure water jet across a containment vessel at the target holder. In actual explosives tests, rather than preliminary tests, an explosive is located in a casting ring centered on the face of the target holder. The water jet is recorded on film with high-speed photography using a Cordin model 114 framing camera with model 1205 turbine, along with two Vivitar 2HV flash units for lighting. Two cubic centimeters (cc's) of WSF8-AA ball powder were used as propellant and a RP-80 detonator was used to ignite the propellant. Various mirror periods and fire pulse delays were tested in order to locate the water jet on film. Once this was accomplished, the derringer setup and test procedure was adjusted in order to obtain the clearest view possible of the water jet.

*See page 43-7 for a graphic representation of the derringer apparatus.

A COMPARISON OF RELAXATION SPECTRA FROM STORAGE MODULUS FOR AFR700B ADVANCED COMPOSITE MATERIAL

Robert J. Skebo Jr.
Beavercreek High School

Abstract :

The relaxation spectra from storage modulus were investigated for different samples of AFR700B advanced composite material. Baseline values were taken from As-Cured AFR700B and compared to Post-Cured AFR700B which was subjected to an additional high temperature/high pressure autoclave environment. During the experiments, samples of AFR700B were heated to 250°C and 300°C while being physically oscillated every hour for 24 hours. Data compiled from this process was used to graph storage modulus versus frequency and eventually learn more about the composite's relaxation spectrum.

IMPACT TEST RESEARCH ON JPATS MANIKIN STUDY AND BIODYNAMIC DATABASE

Laura L. Stafford
Centerville High School

Abstract

The JPATS manikin study tested several manikins on the Vertical Deceleration Tower applying downward impact decelerations and also on the Horizontal Impulse Accelerator applying forward and lateral impact accelerations. The tests performed on the manikins were compared to human test results and analyzed to determine if the manikins simulated human response. These manikins are needed to evaluate dynamic response to impact stresses that are not safe for human volunteers. The tests incorporate several different levels of impact on each manikin, and the response of the manikins to the impacts (in the x, y, and z axes) are measured and analyzed to determine if the manikins can be used to investigate human response to the impacts of escape systems. Additionally, references used in impact related studies and reports are put into the Biodynamic Database so that researchers can easily obtain them.

FLOW CALIBRATION SYSTEMS MODIFICATION

Ross Stevenson
Coffee County High School

Abstract

Flow meter calibration on multiple fuels requires the ability to fill and purge flow lines and calibration systems. The integrity of the calibration is dependent on the ability to identify the consistency of the fluid used in the calibration. Proper placement and adequate arrangement of valves expedites the process of changing fuels.

SPEECH PROCESSING

Patrick R. Stout
Camden Central High School

Abstract

During my tour at Rome Laboratory, I was involved in three different projects. For each project, I supported the engineers and developers in the Speech Processing Laboratory. The first was the creation of a database for audio recordings that were obtained on a field data collection. The second was the preparation of audio data from a 911 call. The third project was the creation and inspection of audio data for a verification system.

Electrical and Magneto-optical Measurements of Doped and Undoped InP Thin Films

Lauren M. Theodore
Lincoln-Sudbury Regional High School

Abstract

Electrical and magneto-optical measurements were made of transition metal- and rare earth-doped indium phosphide (InP) thin films grown on (100) InP substrates. Dopants included manganese, terbium, erbium and europium. Electrical properties of the films (the carrier concentrations, mobilities and resistivities) were measured using the Hall and van der Pauw techniques. The magneto-optical property of interest was the Faraday effect. In general, the rare earth- doped films were n-type with carrier concentrations on the order of 10^{17} cm^{-3} and mobilities around 3000 cm^2/Vs. As expected, at 77K the carrier concentrations of the films decreased while the mobilities increased. Doping with manganese caused the films to become p-type. Both erbium and europium additions to the melt caused a decrease in carrier concentrations by an order of magnitude due to gettering effects. However, erbium appears to be a much more effective gettering agent than europium because, after the initial addition of rare earth to the melt, subsequent erbium-doped films continued to maintain low carrier concentrations, whereas europium-doped films did not. Also, the mobility increased by several orders of magnitude after erbium was added to the melt. In studying the Faraday effect, both undoped and iron-doped InP samples were measured to have Verdet constants of 4.4°/T/mm and 5.9°/T/mm, respectively. As expected, a linear relationship was shown to exist between the degree of rotation and the path length. By subtracting the measured substrate rotation from the measured rotation of a doped film, a Verdet constant of approximately 22.7°/T/mm was calculated. As shown by these measurements our technique appears to be an effective method for measuring Faraday rotation.

AN INVESTIGATION OF $InAs/In_xGa_{1-x}Sb$ BAND GAP PROPERTIES WITH RANDOM LAYER WIDTHS

Jeroen W. Thompson
Beavercreek High School

Abstract

Using the transfer matrix technique, a model of the $InAs/In_xGa_{1-x}Sb$ superlattice was developed. This was used to study the effects of random layer width variations on the band gap and the cut-off wavelength through a Monte Carlo approach. The results indicate that a greater than 1 monolayer control over the growth of $InAs/In_xGa_{1-x}Sb$ is required to maintain uniform detector response.

CONSTRUCTION OF ELECTROCHROMIC DEVICES UTILIZING CONDUCTING POLYPYRROLE

Albert Tu
High School Apprentice
Fuzes Branch
Wright Laboratory Armament Directorate

Abstract

Since their discovery in 1977, conducting polymers have been studied extensively with a special interest in applicational use. The field of polymeric electronic displays has especially drawn attention[1-8]. The purpose of the investigation was to construct a feasible electrochromic device utilizing a thin film conducting polymer. Polypyrrole was electrochemically synthesized with a range of dopants. Thin film polypyrrole was used in the construction of a multi-layered electrochromic device. The electrochromic characteristics were then investigated to create improved devices.

The Effects of 3 Anti-Emetic Compounds on Sleep Duration and Quality As Measured by Actigraph and Activity Logs

Jonathan S.Vinarskai
Castle Hills First Baptist Christian School

Abstract

Jonathan Vinarskai

US Air Force personnel must be prepared for many contingencies to ensure the mission succeeds. For example, crews may suffer exposure to low level radiation in future conflicts resulting in severe nausea and producing catastrophic effects on their ability to accomplish the mission. Two novel compounds under consideration as nausea prophylactic agents by NATO, Kytril and Zofran, were tested and found to have no effects on cognitive ability. This study evaluated the effects of the two agents on fatigue and oral temperature as well as on the quality and duration of post session sleep.

The 20 male and 4 female volunteers were selected from military personnel at Brooks AFB. Subjects received actigraphs and activity logs the day before the first session. They were required to wear the actigraphs and fill out the logs for the 9 days to follow. There were four session days; one each for Kytril, Zofran (the test drugs), Compazine (the positive control) and placebo. Order effects were controlled for using a latin square design which mixed up the order in which subjects received the drugs. The session days were separated by a day off to allow for drug washout and sleep recovery before the next session day began. During a session day, subjects were required to go to work as normal and to arrive at the human performance testing habitat by 1630. Hourly cognitive tests then ensued until 0200 at which times the subjects were released.

No differences were found for session days in the amount of pre-session sleep nor post session sleep. During a session, no differences were found for oral temperature nor subjective fatigue scores. These data further support the use of Kytril or Zofran as prophylactic agents to radiation exposure. The study also allowed a comparison of actigraph and log data. The actigraph may offer the most important advantage in objectively recording sleep/wake data whereas log entries are subjective and prone to human error. However, log data can include other data not available on the actigraph like oral temperature and subjective fatigue scores. However, both techniques ultimately provide data that compliment each other and, if possible, both should be used in operational research.

Bricks, Moments, and a Tetrahedral Search

Josh Weaver
Niceville High School

Abstract

My first project of this summer, Bricks, was to study the introduction of fragments into the continuous media modeled by a Finite Element Mesh. This was done by identifying the exterior nodes of a given subvolume of the mesh. In addition to writing the actual program, I designed a plotting utility that was used to visually check the accuracy of my algorithm.

Another summer project was to revise and document Moments, my main project from last summer. It consists of a Graphical User Interface for a FORTRAN program, written in the 1980s, that calculated the weight, center of gravity locations, and polar and transverse mass moments of inertia for axisymmetric projectiles.

My main project of this summer was to develop a translator program to convert data files from the EPIC hydrocode into the proper format for SpyGlass Slicer for the PC. The conversion was from an unstructured mesh in EPIC to the structured format required by Slicer. The project was complicated by speed and file size problems.

Additionally, I helped design the homepages for the Warheads branch, wrote two data conversion programs, and cataloged reel-to-reel and VHS videos.

Translator for EPIC FEM Time-History Files

Gabrielle White Wolf
Choctawhatchee High School

Abstract

The EPIC hydrocode records highly dynamic variables such as temperature or pressure over a period of time at certain locations on an object; it transfers this data to an output time-history file in binary format, which is created each time the EPIC program is run. The EPIC POST2 time-history post-processor can convert this to ASCII format to make it portable, but it is not in a format that is easy to access via most commercial X-Y plotters such as Microsoft Excel and Spyglass Plot software. This translator performs the conversion so that the data is accessible to these programs.

The translator program was created in FORTRAN in order to sort the data into system, node and element information and write the data to specific files for further use. The translator was run on several example files from EPIC software and the output files of data were then graphed using Spyglass Plot; results were compared to the example graphs included with the EPIC program. The extreme similarity between the two graphs implied that the translator could be used for further sorting of data in time-history files for graphing and analysis.

PART I

NARCOTIZATION OF TUNICATES

Michele Wisdahl

Port St. Joe High School

Abstract

Tunicates must be narcotized prior to preservation in order properly to prepare them for dissection and identification. Species react differently to anesthetics that have been reported in the literature. Tunicates were subjected to tricane methane sulfonate (MS-222), chloral hydrate, magnesium sulfate, menthol crystals and potassium chloride to determine which, if any, would best narcotize *Styela plicata* and *Molgula occidentalis*. The most efficacious narcotization procedure was the use of tricane methane sulfonate followed by injections of formalin into the siphons of the test individual.

MICROSTRUCTURAL ANALYSIS OF PBXN-110 TO DETERMINE VOID VOLUME FRACTION AND PARTICLE ANALYSIS

Tuan P. Yang

Abstract

The explosive, PBXN-110 and it's solid components, HMX Class II and III, were studied. PBXN-110 is composed of sixty-six percent HMX Class III crystals, twenty-two percent HMX Class II crystals, and twelve percent inert binder. Particle analyses of HMX crystals show that the majority of the sizes range from three-hundred microns up to eight-hundred and forty-one microns. Scanning electron microscopy (SEM) confirmed the measurements and showed few flaws in the crystals themselves. Mixing and casting were carried out under vacuum. The different samples were then cut up and densities determined. Three different methods were used to determine the densities of the PBX specimen. These included: the penta-pycnometer apparatus, the Mettler Density Determination Apparatus and hand calculations using weight, length, and diameter. Then SEM pictures were taken to determine the topography of the PBX. Using these pictures, physical measurements were accomplished and comparisons were made. Results show that the particle distribution does not match with those of the HMX specifications and that the void volume appears to be around the crystals and not distributed throughout the rubber matrix. Results also showed that the SEM analysis does provide quantification of the HMX particles in the matrix and can also be numerically modeled.

A STUDY ON EEG COLLECTION AND INTERPRETATION

Stephanie L. Zigmond
East Central High School

Abstract

Experiments were done to identify subacute effects of multiple +Gz exposures. Studies on EEG instrumented male Sprague-Dawley rats were done using the Small Animal Centrifuge (SAC). These animals were exposed to increasing +Gz stress for two consecutive days. EEG data was then analyzed using Fast Fourier Transform (FFT), and Band Pass analysis. Analysis of EEG signal was needed to pin point the following: the approximate time consciousness was lost, baseline conditions, and helped in measuring prolonged G-LOC effects.